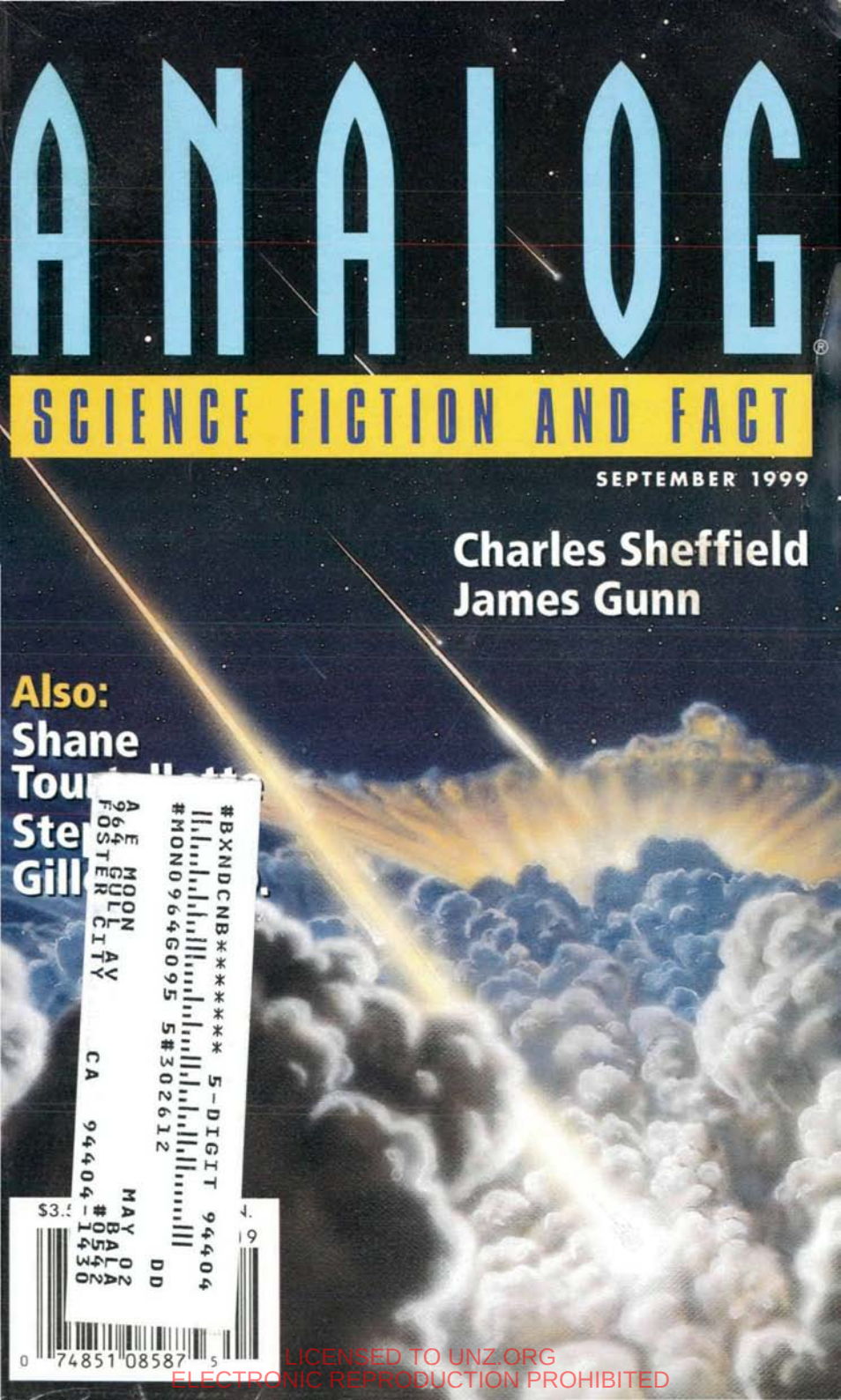

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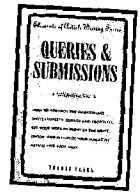

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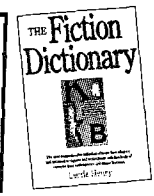

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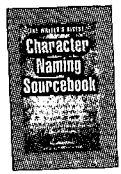

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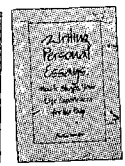

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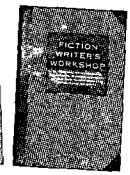

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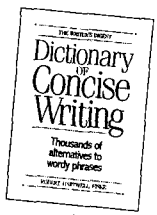

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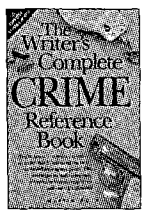

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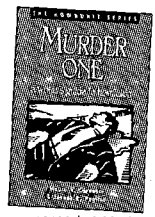

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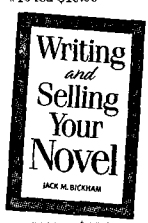

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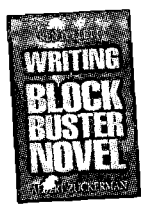

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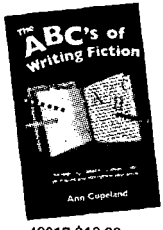

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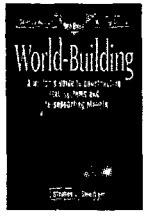

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EDITORIAL Stanley Schmidt

THE FRUGAL PHYSICIST

One of the few areas of professional concern shared by scientists and engineers of virtually all kinds is that of funding: where will the money come from to do what they want to do? The concern has grown particularly strong in recent years, particularly in areas of basic or "impractical" research. More and more, funding has been channeled toward things geared to a specific application, leaving proposals aimed at simply gaining new fundamental knowledge high and dry. Even goal-oriented projects may have to be attempted, if they are attempted at all, with far fewer resources than their proponents estimate they need. Those who view knowledge as an important goal in itself, and even many of those aiming at something more concrete, are understandably disgruntled and disturbed.

But might there be a bright side to this trend?

Before my former colleagues in physics leap upon me with cries of "Traitor!," let me point out that I raise the question only in the spirit that *all* possible answers to *any* question deserve to be examined for any merit they might have. Even though it's been a while since I made my living at physics, I'm still always sorry to hear of a worthwhile research program being axed for budgetary reasons. A few years back, for instance, I sympathized with those physicists who had the opportunity to explore drastically new territory pulled out from under them when the Superconducting Supercollider—which would have been the world's most powerful particle accelerator—was canceled. I have lamented the elimination or drastic reduction of funding for a multitude of projects in space exploration and SETI (the search for extraterrestrial intelligence).

Yet still I pose the question: might some good ultimately come of scientists not being given all the money they would like to have? Might it be, for instance, that researchers who don't get everything they ask for will be thereby inspired to find cheaper, and maybe even better, ways to get the same results?

It's a very well known phenomenon in everyday life that some people with lots of money are forever falling into debt and grumbling that they just can't make ends meet, while others with far less do just fine, maintaining a modest but comfortable and stable standard of living. Most of us have known, or at least known of, people who were born to wealth and given everything they could desire as they grew up—into adults with no conception of how to manage their resources. And we've known others raised in families of very limited means who learned—because they had to—to squeeze the maximum possible value out of every dollar they had.

But to address my question about whether a similar effect might occur in research funding, I don't need to rely on vague parables of prodigal sons or grasshoppers and ants. I can point to real-life examples from actual research where limited funds have inspired people to find alternate approaches that were not only cheaper, but better. There is already some evidence that NASA's recent emphasis on larger numbers of smaller, cheaper missions is producing some good results. The evaporation of

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public support for SETI has led to private programs taking over the search, such as The SETI League, described by H. Paul Shuch in a February 1996 *Analog* article. By dividing the job up among a large number of amateur and professional observers, that has the potential for a whole-sky survey that likely would *never* have been done with public funding.

A particularly spectacular example is the history of proposals for getting human explorers to Mars. Robert Zubrin has traced this eloquently and in far more detail than I can here in his 1996 book *The Case for Mars* (The Free Press, 1996; reviewed in *Analog* in May 1998), but the essentials (see especially his third chapter) are simple enough. When President Bush proposed the Space Exploration Initiative in 1989, a committee representing many facets of NASA set out to determine how it might be done, and came back with a proposal for a huge, complex program estimated to cost $450 billion.

It soon became evident that, no matter how well the proposal would work technologically, there was no way it was going to fly politically with that price tag. So the "Mars Underground"—Zubrin and a few other individuals who were fiercely determined to see Mars explored and colonized—took a long, hard look at all the assumptions underlying that proposal and eventually hammered out a counterproposal that would be far easier to realize. Their express goals were "Simplicity, Robustness, Low Cost, and High Effectiveness," and their "Mars Direct" plan looks far superior to the original proposal on all counts—including costing an order of magnitude less.

I should probably emphasize at this point that I am *not* talking here about the relative merits or legitimacy of private or public funding. That's a whole different issue, and letters dealing with it will not be seen as responses to what I've said here. I also anticipate being told that scientists who want more money should do a better job of justifying it, but that, too, is a separate concern. My concern at the moment is not with how much research funding should come from public sources, or how it's obtained from whoever provides it, but solely with what effects the availability of funds, *regardless of source*, might have on the quality of research—as measured by its results.

Mars Direct appears (though it remains to be tested in practice) to be a case where people who knew they couldn't expect much came up with a far *better* plan than those who (not unreasonably, at the time) thought they could get pretty much whatever they wanted. If stringently limiting funds had that effect once, it might well have it in other cases, too. So might *anybody* who supports research get more and better results by routinely cutting way back on budgets?

Well, maybe—but only up to a point, and with several strong caveats.

First, bear in mind that the Mars Underground included some exceptionally

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imaginative, clever, and determined people—and of all the people who've looked at the Mars problem, as far as I know, only they came up with Mars Direct or anything like it. Most people, including many quite capable ones, if told that they had to design a Mars mission for the cost projected for Mars Direct, would have simply abandoned the goal as unachievable within the constraints imposed.

Second, when cutting the fat from *any* undertaking, it's essential to be able to recognize when you're going beyond fat into muscle and bone. Certainly it's desirable to minimize waste, and simply handing *anyone* whatever they ask for provides little incentive to do that. But some things *can't* be done as cheaply as you might like. High precision and accuracy by their nature tend to be unavoidably more expensive than rough approximations. Things requiring lots of energy are unavoidably expensive; there is no known way to do cheaply the things that the Superconducting Supercollider would have done. The many small searchers of The SETI League may have an advantage in coverage, but they cannot achieve the sensitivity a large installation could have.

Setting arbitrary and unrealistic limits on costs may simply discourage people from doing something that they *could* do for a cost somewhere *between* what they'd like and what you choose to offer. If you force them to try to do it anyway, with funds that simply won't cover minimal necessities, you'll wind up with shoddy work at best and a disaster at worst.

Finally, what you can do expensively today, you *may* be able to do cheaper tomorrow. Sometimes a *lot* cheaper—but that by no means implies that you can do it cheaper *today*, no matter how much you would like to. History is just full of cases where it was necessary to learn how to do something expensively before anybody could see how to do it cheaply—and even if the cost eventually became ridiculously low, the decline had to be achieved through many stages of hard work, none of which could be short-circuited or bypassed at will.

One obvious, pervasive example is the amount of energy available to a human individual, which has gradually increased from the hundred or so watts controlled by his or her own muscles, to the thousands of watts now available to practically anyone in an industrialized culture at the touch of a button. Another dramatic example particularly evident

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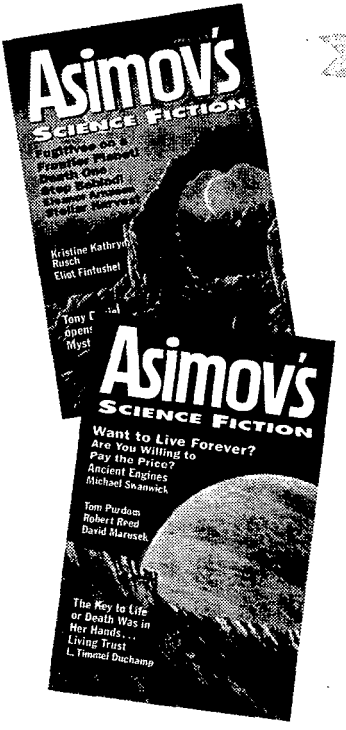

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in our own recent decades is the evolution of electronics in general and computers in particular.

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So if you're funding research—whether you're a government, a concerned citizen, a corporation, or a private foundation—deciding how generous to be is by no means a simple job. We *need* research, both fundamental and applied, and we would like to maximize value obtained per dollar spent. Setting *some* limits on available money may help to do that, not just directly by reducing expenditures, but by motivating people to find more efficient ways to achieve what they're after. But the upper limits set must be realistic and flexible, with the full realization that some *lower* limits are set by nature, human nature, and how many giants' shoulders we have to stand on.■

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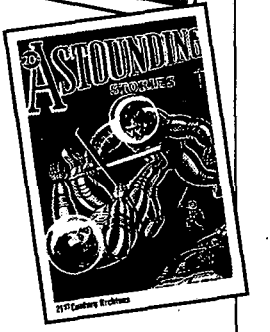

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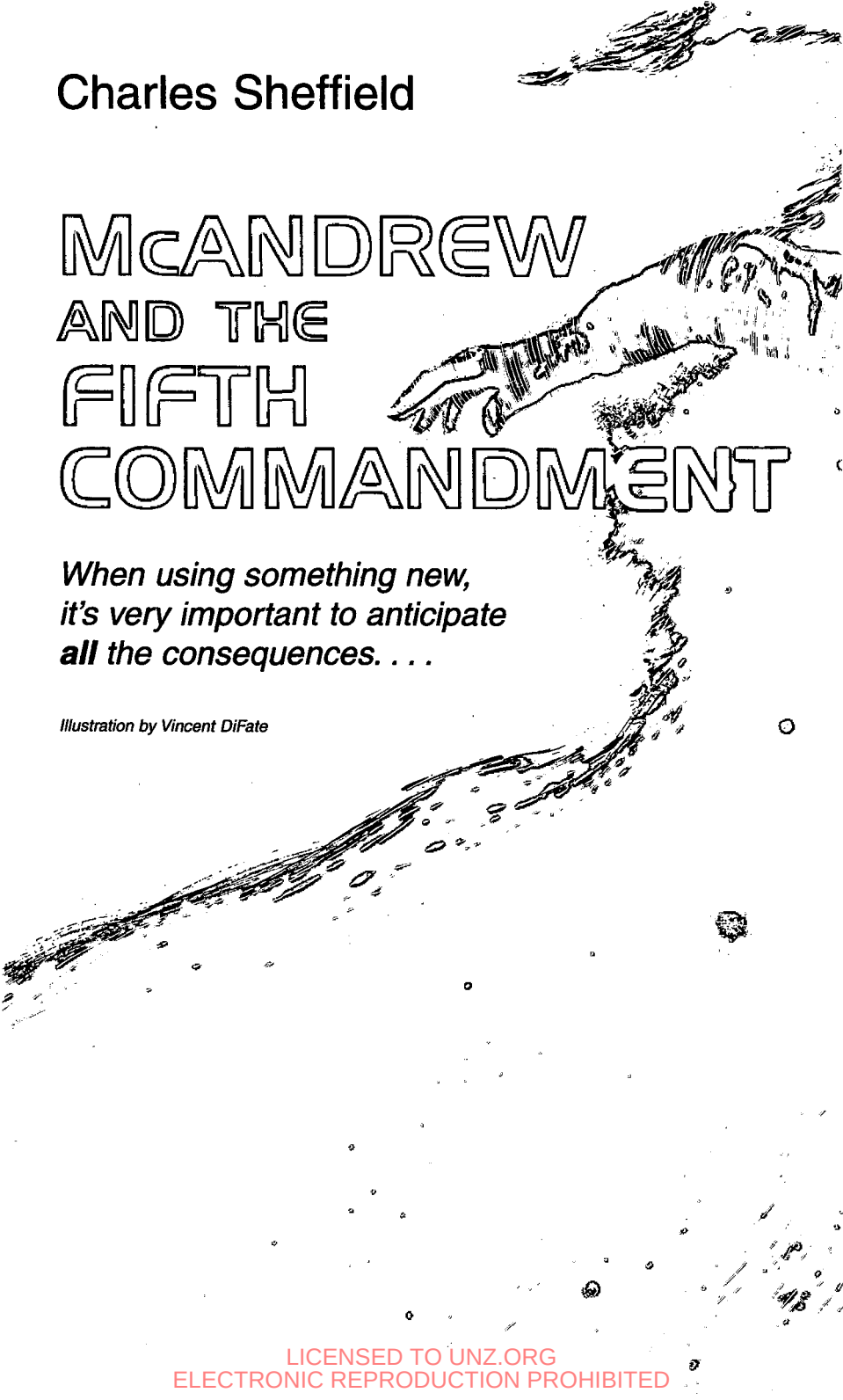

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What do the following have in common: Aristotle, Confucius, Cleopatra, Napoleon, Abraham Lincoln, Einstein, and Madame Curie?

The answer is, each of them had a mother. And if that seems like a stupid and trivial response, I offer it to make a point. Every famous man or woman has a mother. More often than not, we never hear of her. How much do you know about Hitler's mother? Not a thing, if you are like me.

So it was a shock one morning to come to the Penrose Institute and learn that McAndrew's mother was expected to arrive there later the same day. He had a mother, of course he did, but she lived down on Earth and I hadn't heard him say much about her, except that she had no interest in space or anything to do with it.

"Did she say why she's coming?" I asked.

McAndrew shook his head. He looked nervous. He may be one of the gods of physics, the best combination of experimenter and theorist since Isaac Newton, but I had the feeling that might cut little ice with Ms. Mary McAndrew. Probably, she still thought of him as her little boy. I imagined a darling and elderly Scottish lady, gray-haired and diminutive, summoning up the nerve at long last to travel beyond high orbit and pay a visit to her own wee laddie.

"Writing her will." McAndrew spoke at last. "Something about changing her will."

If anything, that confirmed my impression. Here was a nervous old dear, worried about the approach of death and wanting to make sure that all her affairs were properly in order before the arrival of the Grim Reaper.

I said as much to McAndrew. He looked doubtful, and rather more nervous. I didn't realize why until I went with him to the docking port, where the transfer vessel from LEO to the L-3 halo orbit was making its noon arrival.

After a five minute wait, four people emerged from the lock. The first two were Institute administrative staff, returning from leave and laden down with trophies of Earth including a basket of pineapples and a live parrot.

The third one I also recognized. It was Dr. Siclaro, the Institute's expert on kernel energy extraction. He too had been on vacation. He was wearing a flowered shirt and very short white shorts, revealing tanned and powerful legs. The fourth person was a glamorous redhead, dressed to kill. She was right at Siclaro's side, chatting with him while frequently glancing down to eye with interest his calves, muscular thighs, and all points north. From the look on her face he had been protected from direct physical assault only by the new-grown and loathsome mustache that crawled like a hairy, ginger caterpillar across his upper lip.

I was looking past those two, waiting to see who next would emerge from the lock, when McAndrew stepped forward. He said weakly, "Hello, Mother."

"Artie!" The redhead turned and gave him a big hug, leaving generous amounts of face powder and lipstick on his shirt.

Artie? I had never expected to live long enough to hear anyone call Arthur Morton McAndrew, full professor at the Penrose Institute and a man of vast intellectual authority, Artie.

"Mother." McAndrew awkwardly disengaged himself. "You look well." She looked, I thought, like an expensive hooker. "This is Jeanie Roker. I've told you about her."

That was news to me. What had he told her? She took my hand and gave me a rapid head-to-foot inspection. "The mother of Artie's bairn," she said. "Now, that's very convenient."

I couldn't tell from her expression if she approved or disapproved of the fact that Mac and I had had a child together, but I was doubly glad that there had been a lunchtime ceremony honoring old Professor Limperis and I was dressed

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in something a lot fancier and more formal than my usual crew's jumpsuit.

Why, though, was it convenient that I was at the Institute?

"The three of us will talk later." Mary McAndrew was as tall as me, and big blue eyes stared straight into mine. So much for my bent and tiny Scottish elder. "First, though, I need to unpack, freshen up, and maybe have a wee nap."

She looked at Dr. Siclaro. "I hate to impose, but could you show me where I'll be staying?"

"It will be a pleasure." If Monty Siclaro found it odd that he would serve as guide to the Institute rather than McAndrew, he wasn't going to lose any sleep over it. He offered Mary McAndrew his arm and they swayed off together. A mechanical porter emerged from the lock and followed them carrying nine cases of luggage.

I wouldn't pack nine cases for a trip to the end of the universe. As soon as they were out of earshot I asked, "Mac, just how long is your mother planning to stay here?"

"I have no idea." He gazed at me hopelessly.

"But her luggage."

"Doesn't mean a thing. When I was a lad, she'd take six cases with us for a weekend away."

Another revelation. McAndrew not only had a mother, he had also had a childhood. In all the years I'd known him he hadn't said one word about his early days. And I wouldn't hear more about it for a while, because Emma Gowers arrived to drag him away for a seminar with the enticing title of "Higher-dimensional complex manifolds and a new proof of the Riemann conjecture." I may not have learned much in life, but I recognize cruel and unusual punishment when I see it. The speaker was Fernando Brill, whom I recalled had an unusually loud and penetrating voice. I wouldn't even be able to sleep through him. I stayed in the Institute's parlor, where it was the custom of the faculty to meet daily for tea.

It was only two-thirty. I expected a clear couple of hours when I could take a nap, because I had been traveling most of the night on my journey from Lunar Farside. I closed my eyes. Two minutes later—at least, it felt that way, though the clock registered 3:15—a dulcet voice cooed in my ear.

"Why, here you are, my dear. I didn't expect to see you until later."

I opened my eyes. Mary McAndrew was in front of me. She was wearing a green dress, slit to each hip. By the look of it she was not wearing much else. Monty Siclaro stood at her side, giving an impression of a new-found Egyptian mummy.

McAndrew's mother turned to him and squeezed his hand. "You run along now Monty, you sweet man. Jeanie and I need to have a bit of a chat. We'll see more of each other later."

Monty You-Sweet-Man Siclaro, distinguished fellow of the Penrose Institute and leading expert on the extraction of energy from Kerr-Newman black holes, dutifully tottered away. His etiolated look suggested there wasn't much more of him for her to see.

"Now there's just the two of us." Mary Mother-of-Mac sat down beside me. "So, my dear, why don't we find out a little more about each other?"

I learned during the next three-quarters of an hour what she meant by that. I was asked a series of penetrating questions regarding everything from my education and job description to my personal hygiene and tastes in men.

At the end of it she sat back and gave me a big smile. "You know, that is so much a relief. Artie is such an innocent. I was afraid that he might have fallen for a pretty face." She thought for a moment, possibly decided that she was being less than tactful, and amended her statement. "Or he might have found an intellectual. That would be even worse."

I said, "Perish the thought."

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It was wasted on her. "Now I'll tell you what's happening and why I'm here," she said. "First, I'm going to be married."

I made conventional sounds of congratulation.

"Well, I mean, it's as good as being married. Fazool and I are going to live together. He's enormously rich, and he likes the idea that I'm utterly poor. It makes him feel protective—he thinks if it weren't for him I'd be in the poorhouse."

The house I would suggest for her sounded rather like "poorhouse"; but I kept my mouth shut.

"Fazool would be very upset," she went on, "if he ever found out that I had funds of my own. So I've decided to put my money into a trust. Artie is my only child, and the lad will be the ultimate beneficiary. I'm glad you're around to take care of him, because he can be such a dimwit."

I looked around. The tea-room would be filling up in a few minutes, but fortunately the place was still deserted except for the two of us. Describing McAndrew as a dimwit at this Institute would get you the same reaction as chug-a-lugging the altar wine during a church service.

"What about Mac's father?" I asked. "Shouldn't he be a beneficiary?"

"Ah, yes." Her face took on a look of wistful sadness.

"Dead?" I realized that I had never heard McAndrew speak of his father, not even once.

"By all the logic, he is." She smiled sweetly. "But a son-of-a-bitch like that is awful hard to kill."

The arrival of a chattering half-dozen scientists saved me from fielding that remark. Mary McAndrew made an instant survey, checked the line of her skirt to make sure that plenty of leg was showing, and headed for the tallest and most distinguished-looking of the group. It was Plimpton, who according to McAndrew had not had an original thought since he started to grow facial hair and possibly not before. On the other hand, I don't think Mary was seeking original thought. Original sin, maybe.

I followed her toward the tea and sweetmeats. Apparently I had been weighed in the balance and found reasonably adequate. But I suspected that Mary McAndrew employed an unusual scale.

A mother, and now a father, too. I couldn't wait to hear McAndrew's side of the story.

But wait I had to. McAndrew arrived at last from the seminar with half a dozen other scientists. He headed toward his mother. Before they could exchange more than two words, Emma Gowers came sashaying over toward them.

A word about Emma. She is the Institute's expert on multiple kernel arrays and a formidable brain. She is also blond and beautiful, with a roving eye, a lusty temperament, and a taste for big, hairy men of diminished mental capacity.

I was standing only a step away. I saw Mary McAndrew and Emma size each other up, and I realized that neither knew who the other was. But like called to like, and they straightened and preened like two fighting cocks.

"Come on, Mac," Emma said. "You and I have a date."

The wording was provocative, but I knew that Emma had no possible sexual interest in McAndrew. His mother didn't. So far as she could tell, Emma was cutting in.

"I beg your pardon?" she said.

McAndrew made a feeble gesture from one to the other. "Mother, this is one of my professional colleagues, Emma Gowers. Emma, this is my mother."

Mary McAndrew extended a slim and delicate hand. "And which profession would that be, my dear?" Her tone couldn't have been warmer.

Emma gave her a friendly smile. "Not the one you are most familiar with, I'm

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sure." She had been making a close inspection of Mary McAndrew's neck and the wrinkles at the corners of her eyes. "But it's encouraging to know that a person doesn't have to change her line of work, just because she's old. Come on, Mac."

She gripped McAndrew firmly by the arm and pulled him away toward the door. I was left to face his mother.

I said, "It's not the way it looks. She's not chasing him. There's a problem with the balanced drive on one of the ships, and he and Emma have an appointment to take a look at it."

Mary McAndrew seemed not in the least upset. She said thoughtfully, "Well, I certainly underestimated that one. She and I must have a cozy chat when they get back. Where do you say they're going?"

It was easier to show than to tell. I put down my cup and led her across to one of the room's small observation ports. "They'll be going outside the Institute and over to one of the ships. You can see it from here. That's the *Flamingo*, the Institute's smallest experimental vessel."

She followed my pointing finger. The *Flamingo* was berthed about four kilometers away. We had a profile view of the circular flat disk of condensed matter at the front, with the long column jutting away from the center and the small sphere of the life capsule sitting out near the end of it.

"What a strange-looking object!" Mary said. "Why, it's not in the least like a ship."

I stared at her. Was she joking?

"You're looking at a ship that uses the McAndrew balanced drive," I said. "Mac says it's a trivial idea, but it's the most famous thing he's ever done. He's known everywhere in the solar system because of it."

"Is he now?" She peered at it with a bit more interest. "But it's ugly. That plate, and the long spike. And where do the people sit?"

She didn't know, she really didn't. Her own son's most celebrated invention, and she had no idea.

"The crew and passengers go in the life capsule," I pointed. "That's the little ball you can see at the end of the spike."

"But it's teeny. All that big ship, and such a small space for people. What a waste."

"It has to be that way. That plate on the front is a hundred-meter disk of compressed matter, electromagnetically stabilized. If you put people in the middle of the disk while the ship is at rest, they'd feel a gravitational pull of fifty *g*s—enough to flatten anybody. But in the life capsule out at the end of the spike, a person feels a pull of just one *g*. Now when you turn the drive on and the acceleration grows, the life capsule automatically moves closer to the disk. The acceleration and the gravitational force pull in opposite directions. The life capsule position is chosen so the total force inside it, the difference of gravity and acceleration, stays at one *g*. A lot of people call it 'the McAndrew inertialess drive,' but Mac hates that. He says inertia is still there, and the right name is the balanced drive."

I should have more sense. Predictably, I had lost her. In the middle of my explanation she had turned away from the window and she again had her eye on the mentally nulliparous Plimpton.

"Gravity, acceleration, compressed matter," she said. "Oh, how that carries me back. Like father, like son. McAndrew's father, he'd drive a woman mad with talk of compressed matter, when what she was needing was a little personal attention."

"McAndrew, Senior was a physicist, too?" If I couldn't get family information from Mac, maybe his mother would provide it.

"Och, Artie's father wasn't a McAndrew." She arched plucked eyebrows at me. "Perish the thought. I would never dream of marrying a dreadful man like that."

That's the point, right there, where I

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ought to have changed the subject. Instead I said, "Not a McAndrew. Then who was he?"

"His name was Heinrich Grunewald. If he's alive it still is, though I've not seen hide nor hair of him for over thirty years. He'd come visit for a while, then before you knew it he'd be running off. The last time he breezed in from nowhere, just as usual, and we had a lively couple of days. When the two of us weren't busy in private he talked Artie's ears off. I asked him, what was he doing, filling the lad's head with nonsense? Force fields, and quarks, and that sort of rubbish. He laughed, and said that although nobody knew who Heinrich Grunewald was now, Artie needed to get used to the fact that he was going to have a very famous father. Next time he came to see me, he said, his face would be all over the media and we'd be hard put to find private time, what with people camping out on the doorstep of the house."

"I've never heard of Heinrich Grunewald."

"No more you will. Isn't that like a man, all blather and big talk? I flat-out told him I didn't believe him. I said, now what is it you'll be doing to make you so famous? He got mad, the way men do when you talk straight to them. He gave me a bunch of notes and a video recording he'd made that very day, and he said the evidence was all there. He was going off to prove it, and I and the rest of the solar system would treat him with a lot more respect when he came back."

"But he never came back?"

"No more he did. Dead, you'd think, but off with some other woman is just as likely. Heinrich was a cocky devil, and a good-looking man. Good in bed, too, I'll give him that." At the words "good in bed" she roused herself and stared around the room.

"What about the papers and the recording?" I asked.

"Gibberish." She was perking up. Plimpton was giving her the eye and Monty Siclaro, restored to relatively normal condition, had entered the room. "I took a look at the stuff he left, but it was nothing but the same old babble. Strong forces, weak forces, compressed matter, quarks and squarks and blarks. I couldn't make head nor tail of it."

"What did you do with it?"

"Oh. I stuck it away in a lockbox at the old family house. He'd told me not to lose it, and at the time I expected he'd be coming back." Plimpton and Siclaro were standing a yard apart from each other. Drawn by some invisible force, Mary headed for the space between them. "Of course, he never did," she said over her shoulder. "I've not looked for it for years, but I suppose it's sitting there still."

End of story. Except that I, in my folly, later repeated to McAndrew his mother's words.

He stared at me and through me and past me. "Mother never told me that," he said. "He talked about the strong force, and compressed matter, I remember that. But old notes, and a video . . ."

Mary McAndrew stayed at the Institute for two more days. When she returned to Earth, McAndrew went with her.

And me? Of course, I went along, too. I have to take care of McAndrew. He can be such a dimwit.

Plenty of people live on Earth, but when you go there you have to wonder why. The air feels heavy and too dense. In the cities it's dirty and full of fumes and sits in your lungs like thick soup. In the countryside there's the stink of dead plants and animals wafted around on every breeze. Earth people are so used to the smell of rot, they don't even notice. And after a day or two you're just as bad. Apparently your brain can't stand continuous stench, so after a while it cuts off the signal and you don't smell a thing.

Other things, though, you don't get

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used to so easily. Mary McAndrew lived most of the time in Paris or Rome, but the "family house" that she referred to, where Mac had spent his early years, lay on a small island. It was part of a group known as the Shetlands.

Once we got there I could see why she preferred Paris or Rome. Or anywhere. The island sits far beyond the north coast of Scotland, up at latitude sixty degrees. The house was built of solid stone, with great wooden rafters across the ceiling of each room. Mary told me that the building was over two hundred years old, and her family had lived in it for as long as it had been there.

Nothing wrong with that, but I soon learned that the McAndrews were not the house's only residents. Mac and I were shown to a bedroom off on the north side of the building. It was only two in the afternoon, but it was winter for Earth's northern hemisphere and we were so far up toward the pole that it was already getting dark. I stepped into the room and went to place my bag on the bed. As I did so, something small and brown jumped off the counterpane and streaked away toward a gloomy corner.

I gasped and clutched my bag to my chest. "Mac! What the hell was that?"

"Och, that's nothing." He walked forward and peered down at the wainscotting. "Just a wee mouse, and now it's gone. You can bet it's a lot more frightened of you than you are of it."

"I wouldn't bet on that."

"I'm tellin' ye. You'll not see a sign of the beastie once we're moved into the room."

I noticed something odd about his speech. Back on the home territory of his childhood, a Scottish accent was creeping in.

"Puir little thing," he went on, "there's been naebody in this room for so lang, it thought it had the rights to it. Don't you worry, it won't come a-walking over your face at night."

I could have lived very well without that thought. I noticed that the window had a spider's web in the upper left corner, and I wondered how many other animals we were expected to share our space with. I felt a bit more sympathy for Heinrich Grunewald. Given a choice, before you knew it I'd have been running off just as he used to.

I left my bag—tightly closed—on the bed. McAndrew led us back to the long living room of the house. Mary McAndrew was waiting there with a dusty box sitting on the low table in front of her.

"Here it is. And I hope it's been worth coming all this way for it." Her voice said that she very much doubted that. She looked at me, as much as to say, Jeanie, I thought you had more sense. We could all be in Paris. Couldn't you talk him out of it?

If she knew McAndrew at all, she knew the answer. When it's new science, or even a sniff of new science, McAndrew is the most obstinate human in the solar system. He lifted the box as reverently as though it contained the Crown Jewels, blew off dust, and wiped at the top with a yellow cloth.

"It's not locked," I said.

"And why should it be?" Mary said as McAndrew eased the top open with a creak of rusting hinges. "Nothing here that anybody in his right mind would pay a brass farthing for."

At first glance I was inclined to agree. What Mac lifted out of the box was a small notebook with a faded blue cover, a dozen sheets of yellow paper with dirty brown edges, and a video recording of a design that had gone out of use thirty or forty years ago.

"Can you play that?" I asked.

"Oh, surely." Mary took the video container and wiped the top with the duster. "Artie will tell you how it is on the islands. Things don't get thrown away so quick here as in other places."

McAndrew had meanwhile picked up the sheets of paper. He flipped through them in a few seconds.

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"Nothing?" I asked.

"Nothing I didn't know already." He put the sheets down. "Standard results on the stabilization of compressed matter with electromagnetic fields. Same as we do with the balanced drive plates."

"Nothing," said his mother. "Didn't I tell you so?"

McAndrew did not answer, but picked up the blue notebook. He began to leaf through it, and this time he was occupied for much longer.

I didn't speak, either. I had learned long ago that when McAndrew had that look on his face it was a waste of time to try to gain his attention. He was off in a different universe. Mary McAndrew must have learned the same thing, long ago in McAndrew's childhood. She went off to the kitchen without a word and appeared a few minutes later with a loaded tea-tray.

McAndrew finally laid the notebook carefully back on the table.

"Well?" I asked.

"I dinna ken. It's a thing a man has to sleep on."

"That's all you can tell us?"

"I can tell you what he—my father—wrote." Mac said 'my father' awkwardly, as though the words came hard to his tongue. "What I can't tell you is whether what he wrote is true. That needs some hard thinking."

"Nothing there," Mary said. She calmly poured tea. "Nothing, just as I told you."

It occurred to me that after leaving the contents of the box to rot for all these years she wanted there to be nothing.

McAndrew spoke again, slowly and carefully. "What Heinrich Grunewald says—what *he* says"—there was a slight emphasis on *he*—"is that there's another way to produce compressed matter, and if ye do it his way there's no need of electromagnetic stabilization. The compressed matter will be naturally stable. If he's right, you can also achieve far higher densities than we have at present. Up to three billion tons per cubic centimeter."

Mary did not react, but I did. The compressed matter used in the balanced drive plates averaged three thousand tons per cubic centimeter, and that was considered phenomenal.

"Does he say how to do it?" I asked.

"Aye. But that's the hard bit to swallow. He says that it involves a local modification and enhancement of the strong force."

"What strong force?" Mary asked.

I waited for someone to answer. Then I realized that unlike at the Institute, where bulging super-brains stood ready to lecture on any conceivable topic in physics, McAndrew and I were the only two available; and from the look on his face he was gone again, off to some unimaginable place where I could never follow.

"What strong force?" Mary said again. "Have the two of you gone deaf?"

"I'll explain," I said. I should have added, or try to. Make me your authority on physics and you run a considerable risk. "There are four basic forces in the universe." That much I was sure of. "There's gravity, that's the one everybody knows even if they don't understand it. There's the electromagnetic force, that powers electrical motors and everything else to do with electricity and magnetism. There's a thing called the weak force, which causes radioactivity." (At that point McAndrew should have awakened and roasted me for a simplistic explanation. The fact that he didn't meant he wasn't really there). "And then there's the strong force, which holds nuclei together when electromagnetic forces want them to fly apart."

I was about to add that unified theories explained all four as part of a single generalized force, and that all were mediated through the exchange of virtual particles with names like photons and gluons. I didn't. I could see Mary's face.

I finished, a bit lamely, "What your

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husb—what McAndrew's father claims to have done is find a way to change the way the strong force operates. If he was right, and he could make it stronger, then there could be a better way to form compressed matter."

Mary sniffed. "If I'd known that was all I had in the box all this time, I would-na have bothered to keep it all this time." She picked up the video recording. "And here we have more of the same?"

"We don't know yet."

"So let's take a wee look, and find out." She went over to a corner of the living room and pulled back a drape to reveal a playback unit so antiquated that I'd have accepted the idea that it was steam-driven. "Artie, are you awake? Artie! Och, the lad's hopeless."

"Play it," I said. "Maybe it will bring him back into the real universe."

"I have doubts of that. I never found anything that would when he's got that face on him." But she inserted the video recording.

The overhead lights, coupled to the playback unit, dimmed. The wall display flashed a brief kaleidoscope of color, then settled to show the figure of a standing man. It zoomed to a close-up of his face and I had a sudden and startling feeling of recognition. The long jaw and thin-lipped mouth were different, but the distant eyes and high, balding forehead were pure McAndrew.

Heinrich Grunewald spoke. His voice was slow, deeper than Mac's, and slightly accented. "This recording contains its own timeline, giving the date and hour that it is being made. I'll be away for a little while, so I want there to be no arguments regarding priority of invention when I return. I have developed a modified theory of the strong interaction, with huge and various commercial potentials. Among the near-term applications are cheap forms of compressed matter, the ability to make shipment of diffuse materials in much smaller containers, induced radioactivity, more compact forms of existing commercial fusion devices, and low-temperature proton-proton fusion."

McAndrew was awake after all. I heard him gasp at that last item. Grunewald went on, "I am not talking theory alone. The technical details permitting each of these developments can be found here." He raised a blue notebook, like a bigger version of the one in the lockbox.

I glanced at Mary McAndrew, who shook her head. "Nothing like that, not left with me. It's been a long time, but I think maybe I saw it."

McAndrew said, "Then where is it? We have no other lead."

"It went with him." I was surprised that the two of them were slow to catch on. "If it gives the practical details it's worth an enormous fortune. He didn't want to risk anyone else getting their hands on it."

"We have to find it, and him." McAndrew sounded unusually forceful. He saw my expression. "Oh, not the inventions, Jeanie. You know I don't give a damn about them. We need the theory."

Mary McAndrew turned to me. "I told you. He hasn't changed a bit. He needs a keeper."

I asked, "But where did he go?"

McAndrew snapped at us. "If the pair of you would stop blathering, maybe we'd have a chance to find out."

Heinrich Grunewald was still talking. Mac reversed the video to the point where his father was hefting the blue book.

". . . developments can be found here." Grunewald flourished the notebook in a self-satisfied way and finally placed it back out of sight. "With industrial sabotage so common, I do not wish to perform my final validation experiments where others might find a way to steal or even to interfere."

Mary McAndrew said, "Och, he's crazy suspicious. He was always paranoid. I've never known another man to look under every bed before he'd get in

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it, no matter who he was with and what he had to look forward to."

McAndrew and I both shushed her, as Grunewald went on, "So to do the validation I'm taking the *Fafner* out, away from the main shipping lanes—"

"Got him," I said.

"Keep quiet," McAndrew snapped. But I'm a seasoned cargo captain, and for a change I knew something he didn't. It didn't matter whether or not Heinrich Grunewald told us anything else. If he had taken his ship out, as he said, then his flight plan would be on file. So would any firing of the ship's engines.

The man was gone, but not forgotten and not untraceable. It might take a while, but I felt sure we would be able to track down McAndrew's long-lost father.

Like many things in life, the problem I had been so sure I could solve proved more difficult than it sounded.

We headed for the Penrose Institute to perform the calculations. Mary McAndrew told us that she could not come, she had to pay some attention to "poor neglected Fazool." But I was to let her know what we found.

"I know he's surely dead," she said to me as we left for Equatorport. "He was a wicked, obstinate, reckless man. But the two of us had some great times, and I was awful fond of Heinrich. Why, I was even faithful to him."

It would have been unkind to ask for how long.

Mac and I headed for the Institute, and at first everything went according to plan. I delved into the old databases and found the flight plan of the *Fafner*. Among the listed on-board equipment, tantalizingly, the manifest included the enigmatic item, "strong field modifier, prototype."

I learned the exact second of the ship's departure. I found its nominal destination, though that could change through subsequent course corrections or changes of mind. I obtained a complete list of subsequent engine firings, which even without the record sent back from the *Fafner*'s inertial navigation system would allow us to pinpoint the ship's last known location. After all the engine firings, a certain stochastic element affected the *Fafner*'s movements depending on the vagaries of gravitational perturbation by small bodies and variations in solar wind. But natural body positions for anything substantial were in the data banks on an hour-by-hour basis, and the programs to compensate for their effects were routine.

The calculations took a while, even with McAndrew's talent for instant shortcuts. Once we had answers we borrowed the synthetic aperture distributed observation system for a few days and surveyed the sky sector where the *Fafner* should be found.

Result: nothing. Not a sign. No *Fafner*, not in the region we had defined as most probable or in one ten times as big in all directions. The ship had disappeared.

I checked the calculations, redoing everything the long way. The *Fafner* was not a big ship, nothing to compare with a cargo carrier or even a large passenger vessel, but it was thirty meters long and almost fifteen across. Anything that size would stand out prominently on the observations made by the big scope, especially when you used a time exposure to sort out moving objects within the solar system from the fixed celestial background. Comparison with known natural bodies ought to do the rest.

I found nothing wrong with McAndrew's calculations. He checked my checking. That took two more days. Finally we were ready to admit defeat. By this time a dozen others at the Institute were taking an interest. McAndrew phrased the dilemma for all of us. "Objects just can't disappear. Here are the possibilities: The *Fafner* might have totally disintegrated. It might have hidden away inside another object. Or it might

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be deliberately covered with non-reflective material at the wavelengths used by the Institute scopes."

"Or stolen away by aliens," I added. I was tired.

McAndrew nodded as though that was a serious possibility. "In any case," he said, "we've gone as far as we can just sitting and looking."

"The ship can't be far away from where we calculated," I said. I could see where the discussion was heading, and I knew that we faced a very tough job. "It's in the inner system, and near the plane of the ecliptic. In the Asteroid Belt, almost certainly."

McAndrew nodded and looked gloomy. "Aye. Wouldn't you just know it'd be that way?"

The others muttered vague expressions of sympathy.

To see why, imagine that you are asked to look for something small. Would you rather search a large volume or a small one?

The answer to that question depends where you are and what you are seeking. The region of the solar system that includes the Sun, planets, moons, asteroids, and the odd collection of misfit bodies forming the Edgeworth-Kuiper Belt is a substantial volume; it is shaped like a flat pillbox, about thirty billion kilometers across and maybe forty million deep. Say, a billion billion cubic kilometers of volume altogether. But that's infinitesimal compared with the space bounded by the inner edge of the Oort Cloud. There, we are talking a spherical region with a radius of a twentieth of a light year. The volume in cubic kilometers is a number with thirty-five zeroes, too many for me to be comfortable with. You can subtract the volume of the pillbox, and it makes no noticeable difference.

The odd thing, though, is that inside the pillbox it's much harder to find something. And if you had to pick one place where the search is more difficult than any other, the Inner Belt of the asteroids is where you'd least like to be.

The key word is clutter. There are far too many natural bodies in orbit. The Asteroid Belt contains everything from substantial bodies like Ceres, seven hundred and fifty kilometers across, all the way down to house-sized boulders, pebbles, and grains of sand. One good rule of thumb is that for every object of a given size, there will be ten times as many one-third that size.

The data bases at the Institute keep dynamic track of every body of any size, down to ten meters across. The *Fafner* was much bigger than that, so it ought to have been picked up in our search. Recognize that it hadn't been, and where does that leave you? You know there are countless millions of objects near where the missing ship ought to be, and you have no idea at all why your original search failed.

So we would fly out there and take a look for ourselves, and hope that our human brains could spot an anomaly able to fool the smartest computers in the solar system.

How? I had no idea.

McAndrew did. "If it's been blown apart to its component atoms," he said, "we'll never find it. But if it's still in one piece, there's a way that can't fail."

We were preparing to leave, and we were not using a ship with the McAndrew balanced drive. Instead he had picked out an old touring pinnace with a one-*g* acceleration limit. After my initial surprise I decided that I knew why (it would turn out later that I was wrong). McAndrew, it seemed to me, wanted time to think. He'd never admit it, but his pride was hurt. It was bad enough that somebody would come up with a basic idea that he had missed, in an area of theoretical physics where he had thought longer and harder than any person alive. That the somebody was his own father—the father who had run off and deserted him and his mother—was even worse.

As the *Driscoll* eased away from the

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Institute, I compared travel times. Even the most minimal ship equipped with the balanced drive was capable of continuous forty *g* acceleration. With that performance, our destination would have been a mere seventeen hours, standing start to standing finish. On the other hand, at the leisurely half-*g* best suited to the *Driscoll*'s engines, we faced a journey of close to a week.

All right for McAndrew, perhaps; he was sitting barefoot, staring vacantly at the cabin wall and cracking his finger and toe joints in a way that I always found infuriating. I knew from experience that he was likely to sit for days, eating his meals like a zombie and washing only at my insistence. Meanwhile, what was I supposed to do, here in a ship that flew itself?

I reviewed everything we had learned so far. Heinrich Grunewald's paranoia had not ended when he left Mary McAndrew. The *Fafner* required a crew of three when it flew in cis-lunar space. Upon leaving that controlled region, Heinrich as soon as possible had the other two men ferried back to Earth station. He continued alone. His last recorded engine burn placed him in stable orbit in the middle of the Asteroid Belt. Any new engine burn would have been detected. None had been recorded. Any explosion in that location powerful enough to destroy a ship would have been seen. No instruments, on Earth or elsewhere, had seen such evidence.

The ship must be there. The ship was not there. I sat and wondered. Where's Heinrich?

McAndrew emerged from his trance when we still had a full day of flight time ahead. "I've got it," he said. "Or at least, part of it."

"Well, isn't that nice." I should have known better. Sarcasm is wasted on the man. He smiled at me. I went on, "So you know how changing the strong force would allow somebody to do the things that your father claimed?"

He stopped smiling. "Och, I've always known that. It's obvious."

"Not to me it isn't. I don't suppose you'd consider explaining?"

"The strong force holds nuclei together. So suppose you could make it more powerful and act over a longer range, for an indefinitely long period. That would lead to stable compressed matter, and you'd be able to squeeze anything you like into a smaller space. If you used the strong force to overcome electromagnetic repulsion between protons, you'd also be on the road to easy proton-proton fusion at room temperature.

"Now suppose you work the other way round, and know how to weaken the strong force. Then nuclei will be less strongly bound, and a lot of naturally stable elements will become unstable. That gives you induced radioactivity."

"But that's everything." It seemed to me he had covered everything on Heinrich Grunewald's list. "Why do you say you only have part of it?"

"Because I slipped something in there at the beginning. I said, suppose you could modify the strong force for an indefinitely long period. That's the killer, Jeanie. I can see a way to make changes, but they'd be unstable. Worse than that, they'd be unpredictable. You'd never know when the effect would reverse itself and things return to the way they were. And when I try to stabilize the situation over time, I need to assume the existence of isolated quarks. I might find a way around that when I give it a bit more of a think, but I still won't know what went wrong. Something surely did. There must be a missing piece—some trivial point, some fact that I've overlooked. . . ."

He was all set to drift off again. I said, loudly, "Mac, we'd be a lot closer to the something you're missing if we knew how to find the *Fafner*. In another twenty-four hours we'll be sitting out in the middle of the Asteroid Belt, wondering what to do next."

He stared at me with those pale,

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vague eyes. "Why, I already know what we'll do. Why do you think I wanted to take the *Driscoll*, instead of something with a balanced drive?"

"Because you wanted time to think."

"Maybe. And I got that. But we'd have a problem if we'd used the balanced drive. The compressed matter plate on any of those ships masses trillions of tons."

"That's never given us any difficulty before."

"Because we've never had this situation before. Think about it, Jeanie. If the *Fafner*'s still in one piece, what's the one thing about itself it can't hide?"

"Thermal signature?"

"That's not a bad answer for a ship that's alive. Anything with people on board has to generate and give off heat. But the *Fafner*'s more than likely dead, so there would be no thermal signal. A ship can be at the same temperature as its surroundings, or it can change its size and shape, or it can be coated with an absorbing layer so it's hard to see. The one thing it still has, no matter what it does, is mass."

When he spoke that one, final word I could see the rest for myself. We knew from the *Fafner*'s records the ship's mass at the time of final engine burn: three hundred and thirty tons. Even if Grunewald had jettisoned material into space, the present value would not be far from that. If we were anywhere close to the ship we could locate it using our mass detector. The instrument was highly sensitive and it could be programmed to correct for every nearby object in the right size range. The trillion-ton mass of a compressed matter plate was something else. On a ship with a balanced drive, the plate's effects would overwhelm the gravity field of everything in the neighborhood.

It's my one big complaint with McAndrew. He assumes you understand what he understands. Even when you feel sure you know what goes on inside his head, you don't. One of his colleagues told me that the difference between McAndrew and other people is that Mac knows how to think around corners. It's probably true, but it doesn't help much.

I wondered if he got that talent from his father. I had no idea what Heinrich Grunewald had been doing out here, or why he had disappeared thirty years ago from the face of the solar system. I thought of Mary McAndrew's words, "he was a wicked, obstinate, reckless man." Cut out the wicked part, and you had McAndrew.

I can't think around corners, but I have excellent instincts for danger. And I was feeling uneasy, more nervous than the situation seemed to justify.

We had arrived, exactly at the place where the *Fafner* was supposed to be. I cut the drive and used the visible wavelength sensors to scan through a full four-pi solid angle.

Did I see the ship? Of course not. You might say I already knew I wouldn't, because if it had been there the scopes of the Penrose Institute would have found it before we ever left.

I pointed that out to McAndrew.

"Which is why we had to come out here and take a look for ourselves." He seemed filled with secret glee, his normal reaction when facing a scientific mystery. "Jeanie, keep the drive off and the displays on, and let's have a go with the mass detector."

I took a last look at the screens. The optical sensors would find and highlight any unknown body that subtended more than a fiftieth of a second of arc. That meant I would see something as small as a tenth of a meter across, even if it were a hundred kilometers away.

The displays showed absolutely nothing. The *Driscoll* sat in the middle of a large volume of emptiness.

Convinced that we were wasting our time, I turned on the mass detector. Instantly, a loud buzz from the instrument made me start upright in my seat.

"There we are." McAndrew clapped

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his hands in delight. "What do we show for mass and range?"

"Eighteen thousand tons," I said. "So that's not the *Fafner*, it's far too massive. It's at eighteen kilometers." I took another look at the optical sensor outputs. "But Mac, there's nothing there."

"We'll see. Take us that way—slowly."

I did as he asked, but at one kilometer away from the invisible target I stopped the *Driscoll*. "No closer, Mac. That's as near as we're going."

"But there's no possible danger—"

"This ship has to take us home. If you want a closer look, we use suits."

"Jeanie—"

"On a ship you can only have one captain." When I feel a certain way I can be as obstinate as McAndrew.

He knows it, too. He scowled at me, but he didn't argue. He went over and began to put on a suit. I locked the *Driscoll* to hold a fixed one-kilometer distance from whatever was exciting the mass detector, and went across to do the same.

Keeping an eye on McAndrew? Sure. But I had my own curiosity to satisfy. Why were the optical sensors and the mass detector at odds with each other?

He went a meter or two in front of me, heading for the place where the mass detector insisted that we would find an invisible eighteen thousand ton object. The suit displays homed us in on the location. McAndrew went slower and slower. He was using the light in his suit to illuminate the space ahead of him.

Finally he paused, and said, "There you have it!"

"There you have what?" I, only a meter behind him, saw nothing at all.

"The body—the eighteen thousand ton body—that Heinrich used to test his strong force modifier. If he compressed it down to three billion tons per cubic centimeter, the radius would be a fraction of a millimeter—just about right."

Finally, I saw a mote of reflected light. When I moved my head within the suit helmet, I realized that the object was tiny and just a few feet in front of us.

"That thing?" I said. "That's what the mass detector picked up?"

"Of course. What I expected, and what I hoped we'd find."

He reached out with his gloved left hand. Before I could stop him he gripped the tiny particle between his thumb and forefinger. "As you'd expect," he said. "It's tiny, but it should have all the inertia of the original body. Let's see."

I saw him pull, but all that did was move his position. "Doesn't budge," he said. And then, in a different tone, "This is the damnedest thing. Jeanie, I can't let go. My finger and thumb won't come apart—and they hurt."

He was wearing a tough, insulated suit. Cold or heat could not get through it, nor could radiation. If the suit had somehow developed a hole at finger or thumb, air would be jetting out into space. I saw no tell-tale sign of chilled vapor.

McAndrew turned on his suit jets. It changed his body position only by the length of his own outstretched arm. He was stuck, locked in place by an invisible mote.

I heard his grunt of pain and effort. Suddenly I imagined his father, floating outside the *Fafner* and with no one to help him, reaching out to touch the mote of compressed matter and held as McAndrew was held.

I still had no idea what was going on, so my next actions were pure instinct. I said, "Grit your teeth, Mac, this is going to hurt worse than it hurts already," and I took a metal shearing tool from the belt of my suit. Before McAndrew could do anything about it I moved to his suit and severed the top joint of his thumb and first finger.

He cried out in pain as a foam of blood and air spurted from his suit glove. In less than a second the suit sensors reacted and tightened a seal on the fingers. I used the thrustors on my own

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suit to pull us away toward the *Driscoll*. As we backed up I saw the first joints of the finger and thumb, still firmly attached to each other. In my over-stimulated condition they seemed to be moving closer to each other and shrinking at the ends.

McAndrew's suit had decided that he would be better off with a shot of anesthetic. He was still conscious when I hauled us both through the airlock of the *Driscoll* and peeled off our suits. I put him on a bunk and anxiously examined his left hand.

"How is it, Jeanie?" he said. The painkillers left him rational and quite calm.

"Not too bad. The cuts are clean. But there's no way to regrow the joints before we're back home."

"I'll manage," he said. "My own fault. That's what you get when you don't think before you act."

"We'll be home in less than a week." I was already at the controls of the *Driscoll*. "I'll keep you as comfortable as I can until we get there."

"Hey, we can't leave." He had been lying down, but now he sat suddenly upright. "Not without what we found."

"We're certainly not leaving with it. That thing, whatever it is, is lethal."

"It isn't, unless you were as careless as I was. Look, I'll tell you what happened. Then see what you think."

I paused in setting up our flight home. I looked at the mass detector readings, and confirmed that we were still a full kilometer away from the particle of compressed matter.

"Five minutes to persuade me," I said.

"It won't take that long. But you'll have to take my word on the numbers."

"I'll give you that much." When it comes to calculations, McAndrew doesn't know how to make mistakes.

"All right." He lay down again on the bunk and stared up at nothing. "You take a natural body, floating around here in the Asteroid Belt. You go to it, and you place in position there a piece of equipment that locally increases the strong force. Then you turn on the equipment—remotely, from a safe distance. The increase in the strong force makes the body collapse, until it has a density of three billion tons per cubic centimeter. That's what he claimed he could do, so let's believe him. If the body you started out with massed eighteen thousand tons, the one you end up with will be minute. About a quarter of a millimeter across."

"I didn't have any numbers," I said, "but I finally guessed that something like that had to be going on. It's the only way we'd have a strong signal from the mass detector, and not see anything. But you couldn't escape when you took hold of it, and the pain you felt—"

"My own fault entirely. I didn't do the other half of the calculation. Gravity's the weakest force in the universe, but it follows an inverse square law. Take a mass of eighteen thousand tons, and squeeze it down into a quarter-millimeter sphere. What's the gravity at the surface?"

That sounded like a rhetorical question. I waited.

"The field at the surface of the sphere is thousands of *g*s." He held up his damaged hand. "And I was fool enough to grab hold. I couldn't get my fingers free. Not only that—the field pulled in anything close enough. The material of my glove, then the tips of my finger and thumb. I could feel the blood sucking out."

"But I didn't notice a thing," I protested.

"No more you would. The inverse square law got me, but it saved you. Ten centimeters away from the sphere, the pull is down to a hundredth of a *g*—not enough to feel. But close up . . . good thing you were there to cut me away, or I don't know what I'd have done."

But I did. I could see it with awful clarity. The same thing would have happened to McAndrew as had happened to Heinrich Grunewald. Held by the tiny ball of compressed matter, unable to move back to the *Fafner* because of the immense eighteen-thousand ton inertia.

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Except that at the time it had not been eighteen thousand tons. The ball, slowly and inexorably, would have consumed Heinrich, drawing his body little by little into itself. And then, over a much longer time frame, the *Fafner* must have suffered the same fate. The gentle force of gravity would have tugged it gradually toward the speck of condensed matter, closer and close until there was finally physical contact. From that moment the *Fafner* was doomed, just as McAndrew's father had been doomed. As McAndrew himself, without my intervention . . .

I realized that he was speaking again. "But now we know what happened," he was saying in an unnaturally cheerful voice, "there's no danger at all. We'll bring the compressed matter on board, contain it electromagnetically, and take it back with us to the Institute."

"Not on this ship you won't." The most brilliant mind in the system, but sometimes you wonder if he's capable of learning anything. Maybe I ought to be charitable and blame the anesthetic. He was starting to sound decidedly woozy. I went on, "Didn't you tell me, just an hour or two ago, that the compressed matter might be unstable—it could revert unexpectedly to its original condition? Suppose that happened on the way back. Do you want to share your living quarters with an eighteen thousand ton lump of rock?"

"Ah, but I think I see a way around that. If we build the right piece of equipment—"

"You mean when you've built the right piece of equipment. After that's done, and it's been thoroughly tested, and you know it works in every case and there's no danger of compressed matter instability, then if you like we'll come back out here and collect your finger and thumb."

I wasn't worried about his finger and thumb, but I didn't want to say what was really in my mind. *Then maybe we'll be able to give your father a decent burial.*

Ignoring McAndrew, I set the final coordinates for home and turned on the drive. The Mighty Mote we were leaving behind was not going to run away. Heinrich Grunewald, in his strangest of sarcophagi, would still be waiting if and when we came back.

When Mary McAndrew left the Penrose Institute for the first time I would have bet good money that she would never return. Scientists like Plimpton and Monty Siclaro were all right for diversion, an occasional snack as it were, but not for her regular diet.

I would have lost. Mary showed up, one year to the day after her first visit, for the formal ceremony in which an award was made, posthumously, to Heinrich Grunewald for his part in the development of the Grunewald-McAndrew formalism for the modified strong interaction.

McAndrew had insisted that the names be listed in that order. He said that his own contribution, allowing a generator to amplify the strong field externally so that the equipment itself would not be destroyed, was minor. All the major insights for the theory had been provided by the late Heinrich Grunewald.

Mary sat quietly through the ceremony, though I don't think it had most of her attention. She looked very serious and smiled only once, when McAndrew held up Heinrich Grunewald's medal and citation for the visiting media to see. Her dress also seemed odd for the occasion. She wore a long black dress, with a single pearl pinned at the left shoulder. She looked stunning, but she seemed indifferent to the ogling male and female eyes of the media representatives.

After the ceremony was over McAndrew, to his disgust, had to submit to questions and an interview—Institute Director Rumford was not willing to give up such a wonderful opportunity for favorable publicity. As McAndrew left, Mary came over to me.

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She got right down to the point. "Do you think you could show me Heinrich's remains? I want to pay my respects, but Artie refuses. He doesn't seem to like the idea, even though it's his own father."

"I have to agree with him, I don't think it's wise."

"Why not?"

"Well . . ."

"Look, I heard that Heinrich had some sort of accident, and was squashed real bad. But I'm a grown woman, I won't turn hysterical on you or anything."

I wasn't so sure of that. On the other hand, it sounded unreasonable to refuse anyone's request to see the remains of a loved one when a team from the Institute had trailed all the way out to the Asteroid Belt to recover the compressed matter asteroid, and as an incidental had brought back the *Fafner* plus Heinrich Grunewald and a couple of bits of McAndrew's fingers.

"Come on," I said.

I led the way from the auditorium, out along a rarely-used corridor to an annex far removed from the main body of the Institute, and into a small chamber. The Mighty Mote sat in the middle of it, magnetically suspended to prevent it coming anywhere near other matter. A sphere of glass, three feet across, surrounded the exhibit to provide added security.

Mary advanced and stared in through the curved window.

"Where is he?" She turned to me in bewilderment. "You don't understand. I wanted to see Heinrich, no matter how bad he was mashed up in the accident. I don't see anything in there at all."

She had just sat through a series of explanations, especially simplified for the media, about the significance of the work done by Grunewald and McAndrew. The emphasis had been on the inexpensive creation of compressed matter and the successful recovery of the prototype experiment on strong force enhancement.

I intensified the light level and adjusted the angle of the beam, so that the speck of compressed matter appeared as a tiny, bright-blue spark.

"There," I said, "is Heinrich Grunewald."

"That?" Mary stepped close to the window.

"That." I resisted the urge to add, *And most of what you see isn't even him. He's squeezed in there along with the* Fafner *and eighteen thousand tons of rock.*

"Oh dear." Mary pressed her nose to the glass. "That little fly-speck of stuff? Heinrich wouldn't be pleased at all, not with him always going on about size—though I told him, it wasn't important to me. Is there any way of bringing him back the way he used to be?"

"McAndrew's working on it. He has ideas, but it's too soon to say when they'll work. Why do you ask?"

"Well, I don't have that much to remember Heinrich by, and they don't look like they're doing anything for him up here, and it's terribly lonely in this little room. So I was wondering. I don't suppose I could take the whole thing down to Earth with me, could I, and look after him there?"

"I'm afraid that's impossible. What you're looking at is small, but it's enormously dense. That little sphere with Heinrich's remains weighs—" I caught myself in time. She'd wonder about eighteen thousand tons. I finished "—a lot more than you'd think. There would be no way to stop it sinking right down to the center of the planet."

"Oh dear. Then, no. I'm sure Heinrich would like it there even less than being up here." She turned away. "They should have left him out where he was, among the stars. He'd have preferred that. I'm going to say goodbye to Artie, and then I'm leaving."

I trailed along behind, waited while she had a private few minutes with McAndrew, and the three of us went along to the loading dock. She waved, and was gone.

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Next day I was gone, too, on a routine delivery of a kernel assembly to Umbriel. I was away for a month. On the way back I dropped by the Institute, now free-orbiting beyond the Moon.

McAndrew was in his office. It was as crowded and cluttered as ever, with one important difference. Over in a clear corner sat a three-foot ball of glass. Within it sat the grain of compressed matter, and alongside that blue speck stood a small hologram of a smiling Mary McAndrew.

"Mac! I thought you told me the compressed matter was unstable. If it changes back to its original form—"

"It won't." The buds of his finger and thumb joints were already growing nicely. "I worked all that out when you left. It will stay like that as long as we want it to."

"And you moved it in here."

"Well, yes. My mother didn't seem to like him being off by himself. I thought the two of them ought to be together."

"Does she know about this?"

He looked surprised. "Why, no. Or if she does, I didn't tell her."

But I did. After McAndrew and I had agreed to meet for dinner and a long catch-up evening, I left him and placed a call to Mary McAndrew. I tracked her down in Cap d'Antibes, at one of Fazool's mansions.

She listened in silence while I told her about the glass sphere and the hologram in McAndrew's office. Then she said, "I still miss him, you know. Look after him, won't you."

She had mixed two different hims in one sentence, but I had no trouble sorting them out. "I'll do my best," I said. "But you know your son."

"I do indeed. Just like his father. Come and see me, Jeanie. Fazool won't mind. You and Artie both."

"I will."

"In fact, Fazool will probably make a pass at you."

"I can stand that."

"I hope Artie can. Goodbye, Jeanie. Look after him, and give him my love."

"I will. Goodbye, Mary."

We hung up. Look after him. I'd spent twenty years trying to look after McAndrew and it didn't seem to be getting any easier.

I went to find the man to tell him that I had spoken with his mother and we needed to plan another visit to her.

McAndrew thinks he understands what the strong force is in the universe, and I wouldn't dream of disagreeing with him. But Mary McAndrew and I, we know better.■

EDITOR'S NOTE: Earlier stories of Jeanie and McAndrew include "Moment of Inertia" (October 1980), "All the Colors of the Vacuum" (February 1981), "The Manna Hunt" (September 1982), "The Hidden Matter of McAndrew" (June, 1992), and "The Invariants of Nature" (April, 1993).

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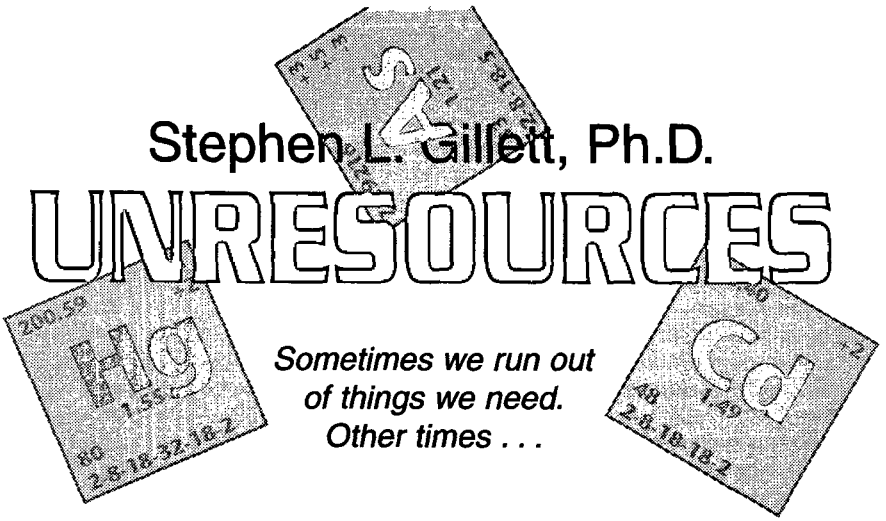
Stephen L. Gillett, Ph.D.

UNRESOURCES



Sometimes we run out of things we need. Other times . . .

We're running out. Of everything. Right? You commonly hear that every element in the Periodic Table is used for *something*, and that the number of uses is continually increasing.

Well, you'd be dubious if you'd spent much time in the resource business, with the collapse of the real prices of nearly all commodities since the shrill "running out" predictions back in the 1970s. But, of course, because prices have collapsed doesn't necessarily mean they'll stay collapsed. It could just mean that we're (say) running off cheap imports, which will become exhausted in their turn.

For certain substances, though, consumption *has* plummeted, and on an absolute basis, not just per capita. And it's not because we're *running* out; it's because we're *phasing* out, largely as a result of environmental concerns. I think of these things as "unresources"; far from digging them up because they're valuable, we go out of our way to avoid them. For if you do dig them up, they're more of a hassle than an asset. You can't sell them, or at least not for much; in many cases you can't even *give* them away. But you can't throw them away, either, because they're treated as hazardous material ("hazmat") and must be disposed of accordingly. And expensively.

Mercury

Mercury (the element, not the planet! symbol Hg) is an outstanding example. According to some of those predictions back in the seventies, Hg was likely to be "the first scarce metal for which available supplies are exhausted; the moment of exhaustion may even be reached in the twentieth century" (Skinner, 1980). Lovering (1969) used it as the example of a metal we were going to have to do without Real Soon Now, and in a *Science* paper in the mid-seventies, Cook (1976) described domestic Hg as a classic example of an "exhausted resource." These prognostications were typically followed by paeans to mercury's unique properties as the only metal liquid at room temperature, its readiness to form low-temperature alloys ("amalgams") with nearly all metals, and so forth and so on—with all that implied for the uniqueness of its applications.

In another paper in the same issue of *Science*, though, Goeller & Weinberg (1976) asked, rhetorically, "What do we do when the mercury runs out?" They made a good case that, though mercury's *properties* were unique, its uses weren't. But they didn't envision mercury's replacement coming to pass through environmental phase-out, rather than through exhaustion.

But in fact that's what's happened. Mercury's uses have been scaled back massively because of environmental concerns. At about the same time we

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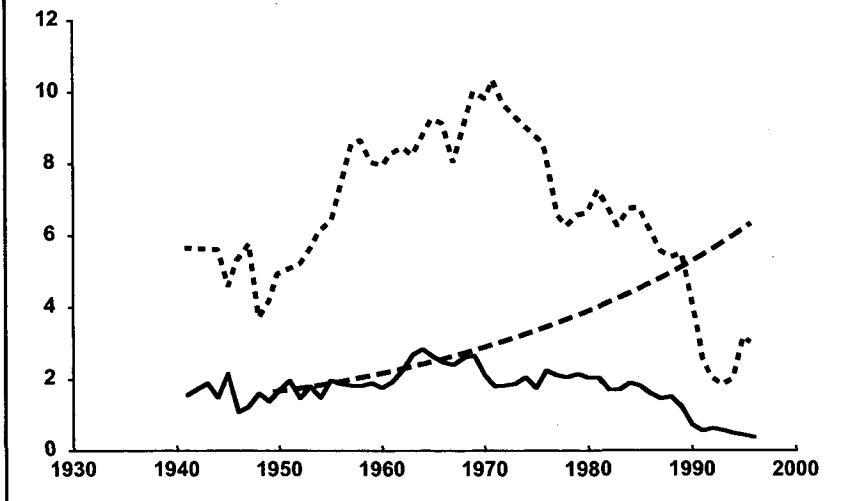
Figure 1 Mercury



Annual US demand (solid line) and world production (dotted line). The dashed line is the extrapolation of a 3% per year increase in demand, based on mid-1960s usage trends, of Lovering (1969). Units in thousands of tonnes; data from *Minerals Yearbooks* (US Bureau of Mines) and (since 1993) *Mineral Industry Surveys* (USBM and USGS).

started to hear of mercury's impending exhaustion, we also became aware of its serious disadvantages. The metal is always toxic, and is exceedingly toxic in some chemical states. It's a neurotoxin to boot: the "mad hatter" from *Alice in Wonderland* was a real phenomenon. Nineteenth-century hatters commonly suffered neurological injury from exposure to mercuric compounds used in processing felt for hats.

And, being an element, of course, mercury does not break down. In fact, some of the biggest present-day problems with mercury pollution stem from the ninteenth century's carelessness with the metal. It was widely used in precious-metal extraction, for amalgamation, with the result that streams and soils around many Old West mining towns are laced with mercury. Not far from where I live, for example, an estimated 7000 tons (!) of mercury is held in sediments along the Carson River, a legacy from mining the Comstock Lode over a century ago.

So, through the 1970s, mercury underwent increasingly stringent regulation—with the result that, since its peak around the mid-sixties, US mercury consumption has dropped by nearly a factor of 10 (Figure 1). For amusement, I've also shown Lovering's (1969) extrapolation of demand, at 3% per year from the average usage in the mid-sixties. Right now the US was supposed to be consuming more than the entire world production, which has also dwindled by about a factor of five from its peak. In fact, though, 1964 remains the peak year of US consumption, at some 2850 metric tons of Hg.

The cost of mercury peaked at more than $800/flask* in 1965, in 1965 dollars; now it's less than $200/flask, and that's in *1997* dollars! So in inflation-adjusted dollars, the price is something less than a tenth of what it was in the 1960s. (Be glad you didn't stash away some Hg as an investment against those "inevitable" shortages!)

What about those "irreplaceable" uses? Sure enough, they were substitut-

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ed; or better, "obsoleted," to use computer-speak. After all, a "substitute" connotes second-best. You use a substitute when you can't get the real thing, right? But technological end-runs have made most traditional mercury uses quaint.

The mercury-filled medical thermometer, for example, has gone the way of the slide rule and the vacuum tube, as you know if you've been to the doctor lately. Now you get your temperature taken with a thermocouple inside a disposable plastic mouthpiece. It's safer (no glass tube to break if you bite down) and *lots* faster. You can even record the temperature digitally if you want.

Similarly, electromechanical switches with that jaunty blob of mercury bobbing inside a little glass bulb are becoming archaic. They're being replaced with microelectronics and microsensors, which are both more compact and more reliable.

A traditional major consumer of mercury was in plants for making chlorine gas and caustic soda (sodium hydroxide, NaOH) by electrolyzing brine. There the mercury served as the negative electrode. The bottom of the electrolytic cell contained a pool of mercury connected to the negative terminal of a DC source. On being attracted to this electrode, positively charged sodium ions (Na^+) from the brine were converted into sodium metal, which promptly dissolved into the mercury to make a sodium amalgam. Even in 1996, this process still accounted for about 1/3 of Hg consumption. But every time one of these antiquated plants shuts down, to be replaced by cleaner, more efficient technologies based on membranes, domestic Hg consumption drops another few dozen tonnes (and another few dozen tonnes of surplus mercury appears on the market, to drive prices down some more).

** By tradition, mercury is sold in 76-pound "flasks," originally iron bottles. Iron is one of the handful of metals that won't spontaneously form an amalgam with liquid Hg.*

Some mercury-containing batteries are still made, for special applications; but Public Law 102-142 ("The Mercury-Containing and Rechargeable Battery Management Act of 1996") mandates their recycling. And though mercury is still used in fluorescent lights and mercury-vapor lamps, newer designs have cut the Hg content to a fraction of what it was a decade or so ago.

In fact, because of the environmental regulations, the recycling of mercury has become a sufficiently profitable enterprise to encourage new companies to enter it (USGS, 1996a)—even as the last US mercury mine, in northern Nevada, shut down in the early 1990s. "Virgin" mercury is still produced domestically, but only as a by-product of gold production; and then simply because it's cheaper to produce mercury than to dispose of mercury-bearing waste!

But finally, I'll dare a categorical prediction here: mercury usage will *never* drop completely to zero. If nothing else, there will be demand in academic chemical research! Of course, *that* will be a fraction of a tonne . . . .

Asbestos

"There is no good substitute for asbestos . . ."
—Charles F. Park, Jr. (1981)

This is another "irreplaceable" resource that was supposed to be running out imminently; and for which demand has collapsed, due to environmental and health concerns (Figure 2). In fact, asbestos use has been effectively banned in the US since the early nineties. (And it used to be stockpiled as a strategic material! *Sic transit gloria mundi. . . .*)

This regulation was a bit ham-handed, to be sure. "Asbestos" is a grab-bag term for a number of different fibrous silicates, and not all are equally dangerous. (And none are dangerous in certain applications, at least if used with a little common sense.) And asbestos does have some extraordinary useful properties; it's non-

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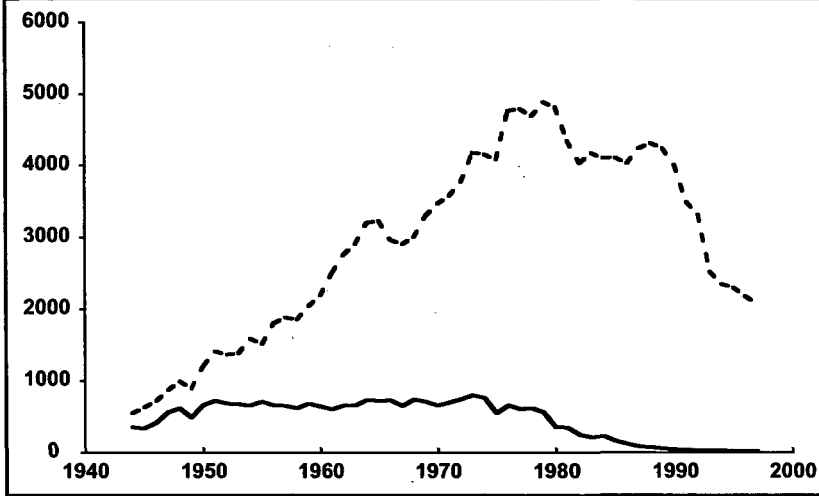
Figure 2 Asbestos



Annual US demand (solid line) and world production (dotted line). Units and sources of data as for Figure 1.

flammable and highly heat-resistant, for one thing. It's also highly resistant to attack by most chemicals. Yet it can be woven into a fabric just like cotton or silk.

But it also *does* cause cancer with enough exposure, inhalation of asbestos fibers being the most dangerous. And that's enough, in a society that fears even a remote risk of cancer more than the immediate and obvious risks of flammability. (Perhaps there was also an element of backlash against the "wonder-fiber" hype of the early twentieth century. Beware of oversell! Much the same phenomenon has occurred with nuclear power.) Yet even so, despite denying ourselves asbestos and its unquestionably useful properties, industrial civilization has hardly collapsed—or even hiccuped.

Note also that the elements making up asbestos were never in short supply. As I said, they're silicates, calcium-magnesium silicates, to be specific. Silicates contain silicon and oxygen as essential constituents; in fact, the fibers contain silicon-oxygen-silicon links running along their length. Now, oxygen, silicon, calcium, and magnesium are, respectively, the first, second, fifth, and eighth most abundant elements in Earth's crust, by weight. So, the prognostications of asbestos shortages made *two* bad assumptions: first, that its uses were irreplaceable; and second, that it would be prohibitive to make from its constituents. But no doubt, if we decide we want asbestos fibers again in a few decades, they'll be easy enough to make *ex nihilo* from the raw elements by molecular nanotechnology, even if there are none left to mine.

Cadmium

Cadmium (Cd) has a number of nice features. It electroplates onto quite a number of metals to yield a tough, corrosion-resistant finish. It also yields a number of brilliant, light-stable pigments (e.g., "cadmium yellow").

It also has a serious disadvantage: ingested, it's about 200 times as toxic as lead. Cadmium, being the heavier cousin of zinc in the Periodic Table, interferes with zinc biochemistry—and zinc is a critical micronutrient for things like enzymes. It also interferes with calcium: cadmium can substitute for calci-

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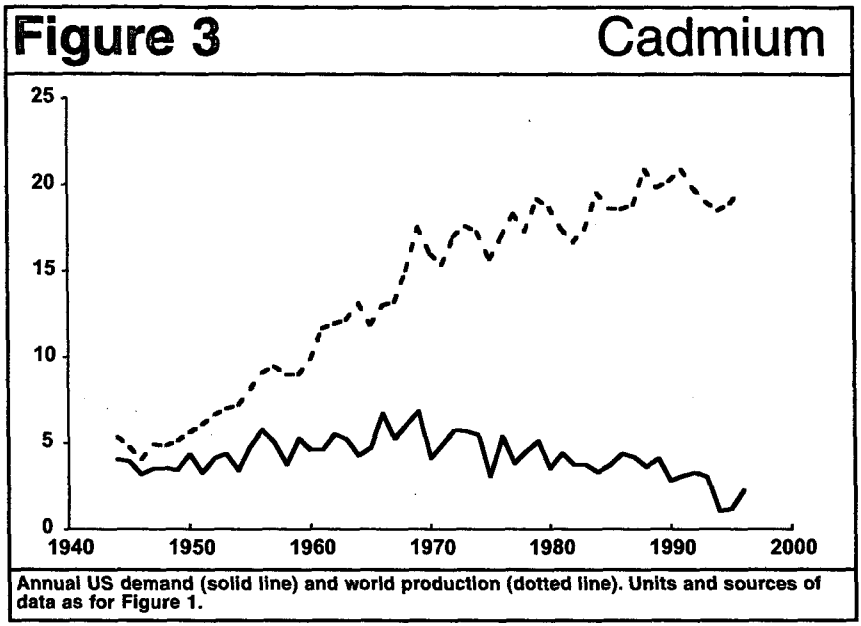

Annual US demand (solid line) and world production (dotted line). Units and sources of data as for Figure 1.

um in the bones, with ghastly results—as was horribly demonstrated in Japan in the 1950s, with farmers living on land contaminated by tailings from a zinc-cadmium mine.

For this reason, Cd consumption in its traditional uses has plummeted (Figure 3). Electroplating has dropped over 70% since the mid-sixtiess in the developed countries, and Cd-based pigments are being phased out wherever possible. Most plating uses have been replaced with zinc; which, with newer technology(!), turns out to be better as well as nontoxic.

A minor use that's grown is in semiconductors, particularly cadmium sulfide (CdS) for photocells, but that's less than 1% of demand. So what's that uptick in Cd usage in the last few years? The big use of cadmium that *is* growing is in nickel-cadmium rechargeable batteries ("nicads"), the ones that power your laptop, portable drill, and so on. With the boom in electronics, demand for rechargeable batteries is growing; and if battery-powered electric cars become abundant, the demand for nicads could explode.

Don't go rushing out to stock up on cadmium, though. For one thing, as the US Geological Survey put it, the "future of the cadmium industry is tied to the development of new recycling technologies" (USGS, 1996b). If the demand for nicads *does* explode, their recycling will be mandated; and that will keep the demand for virgin cadmium down. (Of course, maybe then you'd want to go into the Cd-recycling business!)

For another thing, nicads are hardly the only potential electrical power source. Lithium-based rechargeable batteries are likely to give nicads serious competition; and cheap fuel cells would render *any* batteries completely obsolete, at least for large applications like vehicles.

For a last little irony, it turns out that *fertilizer* is now the largest source of concern for Cd exposure. Cadmium is an impurity in phosphate rock, which is processed for fertilizer, and with enough fertilizer applications the Cd content can build up to potentially dangerous levels in the soil.

Arsenic

After dropping by a third or more from

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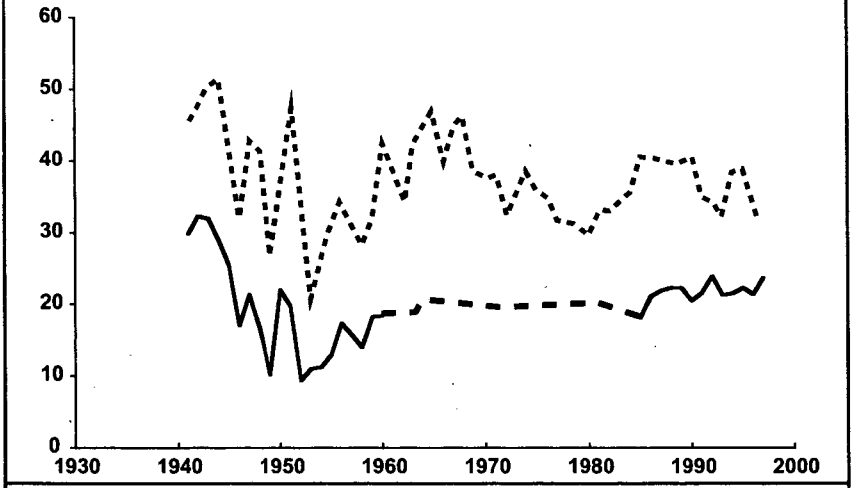
Figure 4 Arsenic



Annual US demand (solid and dashed line) and world production (dotted line). Units in thousands of tonnes; sources of data as for Figure 1, plus Loebenstein (1993). Between 1960 and 1985 USBM withheld most arsenic demand data to avoid disclosing proprietary company data; the dashed lines show where average demand has been interpolated in those years.

its peak demand in the 1940s, arsenic (As) demand has held fairly steady (Figure 4). But, as with cadmium, this gross demand curve conceals more than it shows.

Arsenic's traditional uses were as (yes) a poison. That peak around WW II reflects the application of kilotons of arsenic-based insecticides, largely to control the boll weevil because cotton was important to the war effort. In fact, arsenic was deemed a strategic material and mines were worked for it! (Murbarger (1956) gives an amusing account of wartime arsenic mining at Gold Hill, Utah.) The drop in consumption after the war was due to the introduction of chlorocarbon-based insecticides like DDT. (Which, under the circumstances, may have been an improvement. After all, even DDT breaks down *eventually*. But, like mercury, arsenic's an element and so never breaks down.)

Still, even up through the 1960s, As-based insecticides and herbicides were the element's main use. But, just as with mercury, that growing concern about pollution, around 1970, started a major phaseback. By 1980, most arsenic-based pesticides were banned. The last big agricultural use of arsenate, for a cotton-boll desiccant to dry out the cotton for mechanical picking, was finally banned in 1993. Also, because of worker-safety laws, most non-pesticide uses have been retrenched. A minor use in glass and ceramics has now largely dwindled away, for example.

The fall in arsenic's fortunes is mutely told by its description in the US Bureau of Mines' annual Minerals Yearbook. Up through the early sixties arsenic had its very own entry, amounting to several pages; since then, though, it's usually been listed under "minor metals", along with such things as indium and selenium.

So then why has As use stayed more or less constant since the early 1970s? Because the major use that *has* grown is in wood preservatives. In the US right now, this accounts for some 90% of As consumption. Those treated, greenish boards at your local lumberyard contain a copper-arsenic compound that keeps them

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from being attacked by fungal rot, termites, and other wood-eaters. In fact, such treated boards are now *required* in the foundation by most building codes. This also means that arsenic demand now tracks the housing industry—which is responsible for the uptick around 1990.

Still, this isn't exactly a stable use. For one thing, although the arsenic is thought to be relatively immobile once the wood's treated, the preservative is still under scrutiny. Already its use has been restricted in especially sensitive environments like shorelines.

For another thing, how long is wood going to remain the major construction material for single-family dwellings? There's already growing competition from steel. No doubt the scale of wood usage will depend on the price of lumber and the conservatism of contractors.

The only use of arsenic that has not only blossomed in the last few decades, but that seems set to continue doing so, is in semiconductors such as gallium arsenide (GaAs). Starting with a smidgen about 1960, this now amounts to several dozen tonnes a year—a whole tenth of a percent or so of the total. In fact, a European Union think tank has encouraged (!) the use of byproduct As in semiconductors, because arsenic tightly bound into a semiconductor crystal is not only useful but environmentally benign (Ayres & Ayres, 1996).

Nonetheless, arsenic's still not worth digging up. It's difficult and expensive to dispose of arsenic-containing material, as it's legally treated as hazmat for obvious reasons. Impure arsenic trioxide (As_2O_3*) is recovered as an (unwanted) by-product of gold mining here in Nevada, and I've heard that at least one company is accumulating drums of it in a warehouse. They can't sell it; they can't even *give* it away, but they can't throw it away, either!

Yet we presently import As_2O_3 to make all that wood preservative. Why don't we just reprocess these smelter by-products? After all, as I mentioned, some of these same mines recover mercury as a by-product.

'Cause it would be very expensive in terms of up-front time and capital. Hey, if you were a manager at a gold-mining company, would *you* commit company resources to develop a clean extractive process for a toxic, low-value byproduct for which demand is problematic? At least mercury still costs about $2.50 a pound, about 10 times what arsenic trioxide does.

One final irony: despite its well-deserved reputation as a poison, arsenic's recently been shown to be a micronutrient (Davies, 1981). A trace is required by several mammal species at sub-parts-per-million levels, and presumably by humans as well. Nielsen (1991) estimates that an adult human requires about 12 micrograms of arsenic a day. A space colony that had *completely* eliminated arsenic would find they'd need to import a smidgen.

Implications

"Prediction is difficult, especially about the future"
—Yogi Berra

One obvious implication of this review is to distrust confident predictions based on exponential growth. This doesn't *quite* go without saying, because there are still folks out there who confidently extrapolate exponentials. But it's sufficiently obvious that it's not worth dwelling on.

A less obvious implication is the salutary (!) effect of environmental regulation on technological progress. Much regulation, by "setting the goal posts higher," has had the effect of driving technology; of encouraging new technology and new approaches.

This consequence is likely to be considerably more attractive to technophiles

** So-called "white arsenic"; the "arsenic" you read about in whodunits is really As_2O_3.*

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than technophobes. Curiously, though, technophiles often share a notion with technophobes: that the only alternative to the way we do it now is the Way We Usta Do It. And *they*, of all people, should know better. There's always another way, and generally there's a better way. For example, at least one hard SF writer has viewed the ban on chlorofluorocarbons (CFCs) as meaning we must return to the old, noxious, toxic refrigerants like ammonia and sulfur dioxide (see Pohl & Hogan, 1993). This doesn't follow at all. There are better potential refrigerants; but more fundamentally, the whole technology of refrigeration has a nineteenth-century flavor. Compressing and expanding gases, with pumps and arrays of plumbing and high pressures and massive moving parts: is that *really* the only way to cool something off? One obvious alternative is thermoelectric technology. It's still in its infancy (though you can already buy consumer products based on it), but with no moving parts, it's likely to be simpler and more reliable, as well as cleaner.

I'm reminded of an old and rather appalling science-fiction story (Sturgeon, 1941) about a genius engineer who subjected colonies of intelligent critters to a variety of (often fatal) environmental stresses, so he could exploit any innovations the critters managed to come up with to stave off disaster. But at least in our case we're subjecting *ourselves* to the stresses; and so far without fatal results. (And whether the "stresses" are environmental problems, or the regulations implemented to deal with them, is left to the reader to determine!)■

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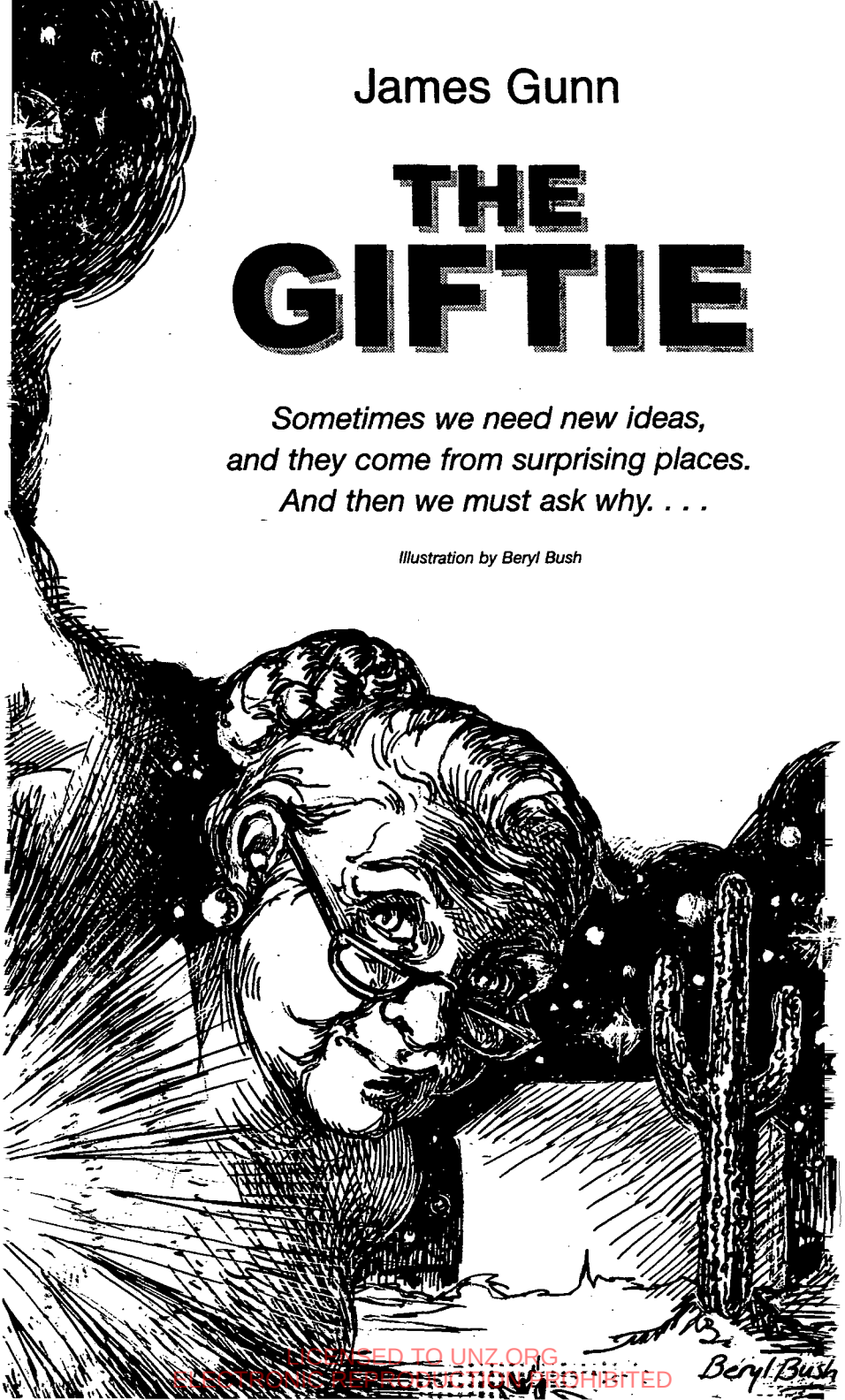
James Gunn

THE GIFTIE

Sometimes we need new ideas,
and they come from surprising places.
And then we must ask why. . . .

Illustration by Beryl Bush



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O wad some Pow'r the giftie gie us
To see oursels as others see us!
—Robert Burns

It all started at the little bookstore where Adrian liked to browse when he had the time. Browsing in the chain superstores wasn't the same. In the superstores you could find almost any kind of book you wanted, and anything you couldn't find could be located by computer and made available a day or so later. That assumed you knew what you wanted, or could find it in the current maze of instant literature. But there were so many books that you couldn't *browse* in an eclectic jumble of old and new. Anyway, the superstores didn't *smell* right. They smelled like, well, like department stores with air recirculated every thirty seconds. Bookstores should smell like old leather and good paper and printer's ink and maybe a little dust.

The book was on a table labeled "Remainders—Cults, New Age, UFOs." The books once had been stacked neatly—the proprietor of the Book Nook, a Mrs. Frances Farmstead, of elderly years but a youthful devotion to books nourished by some sixty years of reading and handling, liked them arranged so that all the bindings could be read at a glance—but now they were jumbled in a heap as if someone else already had rummaged through them.

That honed Adrian's edge of irritation over his inability to get any closer to the goal he had been pursuing since childhood, ever since he had looked up at the stars and, like John Carter, had wished himself among them. The feeling of irritation had been growing in recent months. His ambition to be an astronaut had been grounded by the inarguable facts that he was physically unimposing and his hand-and-eye coordination had always made him last to be chosen at pick-up games. But he had a nimble and inquiring mind, and he had settled for the next best thing: aerospace engineering.

He had worked his way through the University, joined a major aerospace firm after graduation, and resigned after a dozen years of routine assignments that got him no closer to his goal of reaching the stars, through surrogates if not in person. He had set up his own one-man consulting business, and was able to pick and choose assignments that appealed to him and seemed to get humanity closer to freedom from Earth's gravity. But even secondhand space adventuring was hung up on chemical propulsion and obsolete vehicles. His own ambition, like the space program itself, was drifting. Humanity needed something totally new. The irritation had brought him into the Book Nook time and again; browsing had proved, over the years, a treatment if not a cure. But now someone else might have found the one text the book gods had intended for him, for which their mysterious hands had guided him into the store. These remainders were all one of a kind, and once one was removed it was gone forever.

Ordinarily he would not have chosen this particular table—he had a skeptic's fondness for books whose naïve pretensions or paranoid conspiracies he could ridicule to his friends or even to himself—but he was not in the mood for such cynical amusements. The jumble attracted him, however, and he worked his way through the pile, restacking them neatly on the table, binding up, in the way Mrs. Farmstead would have done herself. *The UFO Conspiracy*, *UFOs: The Final Answer*, *UFO: The Complete Sightings*, and *Cosmic Voyage*, along with *The Secret Doctrine of the Rosicrucians*, *The Truth in the Light*, *Psychic Animals*, and other annals of magic and the occult. Adrian could feel Mrs. Farmstead's approving gaze from the antique wooden desk at the front of the store.

He held the book in his hand, turning it this way and that. The book had lost its dust jacket, if it ever had one, but it

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had a pleasant feel to it, and the title was catchy: *Gift from the Stars*. Perhaps it was a Von Däniken clone; he always enjoyed their innocent credulity.

He opened it. The book had a frontispiece, unusual in a cheap text like this. It showed the vast metal bowl of the radio telescope at Arecibo, with the focusing mechanism held aloft by cables strung from three pylons. The title page listed a publisher he had never heard of, but that wasn't unusual: fringe publishers were common in the cult field. The copyright page said that the book had been published half a dozen years earlier.

Adrian glanced at the first page. It was the usual stuff: have we been visited? Are there aliens among us?

He leafed through the book, half decided to put it down, when he came across an appendix filled with diagrams. Not diagrams of cryptic incisions on arid plateaus in Peru or carved around the entrances to ancient tombs. These seemed to be designs for some kind of ship. Not "some kind of ship," he decided with the gathering excitement he recognized as the eureka feeling, but a spaceship, and not the sketchy drawings of some putative crashed UFO concealed in a hangar in New Mexico or Dayton, but engineering drawings such as Adrian worked with almost every day. He took it to the desk.

"Found something you like, Mr. Mast?" Mrs. Farmstead asked. She was old but cheerful about it, with a plump, grandmotherly face and gray hair braided and wound into a knot pinned on top of her head with an oversized barrette.

"Enough to pay good money for it," Adrian said. Mrs. Farmstead didn't accept charge cards, but she had been known to run an account for someone short on cash who had fallen in love with a book. "Any idea where it came from?"

"Of course I do," Mrs. Farmstead said. She maintained careful records that kept her in the shop, Adrian suspected, long after the time of its official closing. "But you don't expect me to look them up for a three-fifty remaindered title, do you, Mr. Mast?" Her sharp glance over plastic-rimmed glasses dared him to ask for special service.

"Not this time, Mrs. Farmstead," he said, paid his money, and took his handwritten receipt and his newfound treasure and walked out of the store, feeling no longer irritated but elated, almost trembling, as if what he had found there would change his life forever.

Nobody was dependent on him except those space travelers not yet liberated from the surly bonds of the solar system, perhaps not yet born; for a dream he had sacrificed hopes for wife and family. Who was he kidding? His problem was that the women he was interested in weren't interested in him, and the ones who were interested in him he found less exciting than his work. Ordinarily, then, there was nothing to draw him back to his one-bedroom apartment, but now a curious anticipation hastened his step.

He delayed gratification by changing to comfortable sweat pants, getting a cold can of beer from the refrigerator and a bottle of peanuts from the pantry, and settled into his easy chair in the living room opposite the television set he turned on only for the news, the science channels, and the sci-fi series. Only then did he open his *Gift from the Stars*.

The first chapter was titled "Where Are They?" Although it seemed to be a discussion of aliens and the possibility that they might have visited the earth in ages past and even might be keeping track of us now, Adrian recognized a subtext the ordinary reader would never have noticed. A conclusion seemed to say that evidence of alien visitation may have been deliberately concealed by nameless government agencies, but that other alien contacts had occurred or were yet to happen that anyone with an eye to the sky or a mind to understand could be aware of. Read with greater so-

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phistication, however, the chapter suggested that the evidence for alien visitation was not only thin but probably nothing more than the connecting of random dots; that aliens were the modern equivalent of angels and demons; and that belief in alien visitation and abduction was a substitute for antiquated religions whose answers no longer seemed appropriate to contemporary questions.

Written between the lines, however, was an argument for the existence of aliens. Logic said that with all the stars in the Milky Way galaxy alone, a good number of them would nourish life and a good number of those would develop technological civilizations capable of interstellar travel. Good scientists had agreed on all that. Surely there must be aliens older, wiser, and more advanced then humanity. But, as Fermi asked, where are they? Why weren't they here by now?

The UFO believers, of course, thought they were here, observing us, maybe abducting people for their experiments, maybe having accidents that left their spaceship wreckage and alien bodies strewn across remote areas of the world to be hidden by government agencies concerned about popular panic or paranoid about alien takeovers, or committed to their own researches and fearful of the release of dangerous information . . . . But *Gift from the Stars* suggested, subtly, that aliens had their own reasons for not visiting Earth, reasons that we could never know, unless, perhaps, we should go visit *them*.

The question Adrian had to answer was more immediate: why should the book he held in his hands be titled and written in such a way that it was virtually indistinguishable from a hundred, maybe a thousand, other books on UFOs and aliens? The only reason he could think of was that the author wanted to hide a message that would be found only by someone capable of noticing and understanding it. Like concealing a diamond in a heap of glass imitations. What better hiding place for obscure revelations than among the books that the only people who would take them seriously were the people that nobody took seriously?

Unable to restrain his impatience any longer, he turned to the appendix. Here were the drawings he remembered. They could be for any kind of vehicle, a submarine, say, or an airplane without wings, but the design had non-aerodynamic extensions as if intended for use where fluid resistance was nonexistent. The drawings were curiously uneven as if they had been prepared by some gross process different from the customary draftsman lines. Gaps in the drawings seemed to indicate details yet to be added or filled in according to individual preferences. But Adrian identified what was clearly a propulsion system based upon the reaction mass being expelled through nozzles at the rear of the vessel. The storage space for fuel seemed too small, however, and the reaction chamber itself seemed oddly shaped and also curiously small. Adrian turned more pages. The book had a second appendix in which he discovered the design for an engine in which two substances would be combined and the energy obtained used to accelerate another substance through oddly shaped nozzles and past some kind of magnetic fields until it was released. A final sketch made sense of the limited storage space and the engine. It was a design for a container in which the substance within would never touch the sides. The substance was some kind of plasma contained by magnetic fields maintained by some kind of permanent magnets built into the vessel, or perhaps the vessel itself was magnetic. A companion design showed how solar energy could be transformed into—what else could it be?—antimatter. Its combination with matter—perhaps hydrogen encountering anti-hydrogen—would convert the mass of both entirely into energy and provide the means by which humanity could reach the stars.

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Would it work? Somehow he doubted it. It was all too pat, like a science-fiction gadget. But maybe that's what all advanced technology looked like—not magic, but obvious. And, like a cultist's scenario, it all made sense, granted the premises, and was not that much different from imaginative concepts discussed in aerospace engineering circles. The difference was that these looked as if they were working designs, not concepts, and even, somehow, as if they were antiquated, like museum pieces or redesigns of historic airships such as the Wright brothers' first craft. It would work, all right, probably better than the original, but it hinted at the existence of methods far more effective. Were those beyond the understanding or the technological capabilities of less advanced species?

Adrian shook his head. He was allowing his imagination to take him into theories as weird as those of any UFO true believer. But that was what the book had done to him: he had picked it up as a minor contribution to a neurotic belief system and it had evolved into a document addressing his deepest needs. And, although the text did not say so, the title suggested that somehow these designs had come from somewhere else, perhaps from aliens. Perhaps they were, indeed, a gift from the stars.

Adrian showed the book to Mrs. Farmstead. "You said you could tell me where this came from."

"Yes," she said, peering up at him. She looked up at him owlishly over her glasses, her plump face framed in coils of gray. "But surely one of these is enough." She looked at his face as if reading his need. "Oh, all right, since it's you, Mr. Mast." She ran a hand-held optical scanner across the ISBN number on the title page and then punched a couple of keys on her computer. "It arrived six months ago in a box of remainders from a jobber. Cheap."

"All cult books?"

"Most of them, I expect."

"Could we find out who wrote it?"

She pointed at the name on the title page: George Winterbotham.

"Could you find an address for him?" Adrian asked. He apologized. "I know this is a lot of trouble."

Mrs. Farmstead seemed about to say something but instead turned back to the computer and called up *Books in Print*. Nothing. She tried several library databases, including the Library of Congress. Nothing. She laughed. "This may be the only copy in existence."

Adrian grimaced. "That may be more accurate than you think."

She looked at him. "What are we doing here, Mr. Mast? Is it illegal?"

"It may be dangerous," he replied, only half in jest, "but it's not illegal unless it is illegal to publish a book revealing information that some people might want withheld."

"Trade secrets?" she asked. "In that?"

He had hoped to keep Mrs. Farmstead out of it. Something about this situation had a wrongness to it—the information that should not be in a book like this, the accidental way it came into his hands, the curious anonymity of its author. He flipped the book open to its appendices. "There are these," he said. "They're spaceship designs."

"How do you know?"

"You know books. I know spaceships," he said. "I don't think I've ever introduced myself: I'm an aerospace engineer. I work in designs like these."

"How very odd," she said and leafed through the appendices. Her expression told him they meant nothing to her. "I'll take your word for it."

"I'd like to find the author and ask him where he got the designs."

"I see," Mrs. Farmstead said. "But why would he publish them in a book like this?"

"Exactly," Adrian said. "It suggests that he wanted someone to find them, someone who would understand what they were—"

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"Like you, Mr. Mast."

He nodded. "And nobody else would know they were there, particularly nobody who might want to keep them from the public."

"And that nobody, or even a group of nobodies, might be dangerous to someone who found out what they didn't want found out."

"I'm afraid so, Mrs. Farmstead."

"Well," she said and turned back to her computer. "I don't like people who want to keep things from being published." She tapped several keys. "We can look up the publisher."

The publisher, at least, was listed on the Internet. He had two books under his name, both UFO texts. Neither one was *Gift from the Stars*. Before Adrian could stop Mrs. Farmstead, she had typed in a telephone number. Somewhere a phone started ringing.

"Hello?" she said into a speaker so that Adrian could hear. "Is this Joel Simpson? The publisher?"

"Yes," came the hesitant reply. "Who's calling?"

"I have a customer who is trying to find another copy of a book published by you half a dozen years ago."

"I've only published two books," Simpson said.

Mrs. Farmstead raised her eyebrows at Adrian as if to say, 'He's lying.' "*Gift from the Stars*."

"There must be some mistake. I never published a book by that title," the voice said on the other end. "Who is calling?"

"Sorry for the trouble," Mrs. Farmstead said. "It must have been another publisher with the same name." She pressed a button that closed the connection. "Well, Mr. Mast? You may be right."

"I wish you hadn't made that call," Adrian said. "I have the feeling that somebody got to Mr. Simpson and scared him into suppressing the book and reporting anybody who inquired about it. Maybe this *is* the only copy."

"I never told him my name."

"There's such a thing as caller ID and even tapped telephone lines."

"I never thought of that," she said. "The way you talk about it sounds like some kind of conspiracy."

"I hope I'm wrong," he said. "I hope I haven't been reading too many of those cult conspiracy books."

"No matter," she said. Her plump face tightened into a look of determination, "We're going to get to the bottom of this, no matter what."

"We seem to have run into a blank wall," Adrian said.

"There are ways around a wall," she said darkly. "As you said, Mr. Mast, books are my business. Just give me a few hours with this computer, and I'll find the author for you—or, at least, where we can locate the author."

"We, Mrs. Farmstead?"

"I told you that I don't like people who want to keep things from being published," she said. "I don't like people who threaten other people, either."

"I won't turn down your help," Adrian said. "But I never intended drawing you into this."

"I am in, Mr. Mast," she said, "and unless you forbid me from helping, we're in this together. But tell me: what is it we're trying to do?"

"We're trying to discover where these designs came from and whether there are more of them," Adrian said. "And then we're going to build a spaceship and go to the stars."

"That's worth taking a few risks for," she said. "I've always wanted to go to the stars." She turned back to her computer.

That night the Book Nook burned down.

Next morning they traveled stand-by to Phoenix. Adrian paid for the tickets with cash that he had withdrawn from an ATM, but he had to give their real names to the young woman who sold him the tickets and demanded photo ID. He had tried to persuade Mrs. Farmstead

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not to go along, but she was determined.

"Your book store has just been burned," Adrian said. "Somebody doesn't want us to follow this up."

They were sitting in the coach section, Mrs. Farmstead in the window seat, Adrian in the seat next to her, leaving the aisle seat empty. They had their heads close together like conspirators.

"Nonsense!" Mrs. Farmstead said. "The building was nearly one hundred years old, and the wiring was almost as old. It was an accident waiting to happen."

"But right after your telephone call?"

"People have a dangerous tendency to connect events, Mr. Mast—."

"Call me 'Adrian,'" he said.

"All right," she said, "and you can call me Mrs. Farmstead." She looked at him over the tops of her glasses and smiled. "Misconnecting events is what's wrong with the UFO fanatics. They get cause and effect all mixed up. Just because two events happen, one following the other or next to the other, doesn't mean they're related. *Ad hoc propter hoc*, it's called."

"So you think—?"

"Coincidence," she said. "That means 'happening together.' I've spent a lot of time with dictionaries. I like words, Adrian, and I think they need respect." They were passing over southwest Kansas with its circular green patches below attesting to the existence of central-pivot irrigation. "Now that's cause and effect, Adrian," she said, pointing out the window beside her. "Like the book that has sent us off on this adventure. Either those drawings are intended to make otherwise unlikely comments seem more believable—"

"Not that, Mrs. Farmstead," Adrian said. "I know legitimate designs when I see them."

"Or, as you suspect, someone has tried to hide a golden acorn on the forest floor."

"That's a good image, Mrs. Farmstead. Only"—he hesitated—"this may be dangerous business." He held up a hand to stop her response. "I know: you think recent events are unrelated, and that there's no danger from people who don't want that acorn found. You may be right. But you may be wrong, and you shouldn't have to take that chance."

"At my age, you mean," she said.

"At any age. You should be home taking care of cleaning up the site of your store, or collecting your insurance."

"And sitting in my rocking chair."

"Rebuilding. Restocking. Whatever."

"I don't choose to retire and, to tell the truth, I was getting a little bored with the book business. People don't buy good books any more. Hardly any books at all to tell the full story. Maybe the fire was a blessing in disguise. It may have liberated me to do something important, like giving humanity the stars."

"That's eloquent, Mrs. Farmstead," Adrian said.

"Besides, as you said, your area is spaceships. Mine is books. How far do you think you'd have gotten looking for spaceships?"

He thought about it. "You're right about that. You found the publisher and his address."

"But not the author," Mrs. Farmstead said. "The book must never have been registered with the Copyright Office."

"But it had a copyright notice."

"That's the law. You can copyright it by putting on the notice, but you don't have to complete the registration. The author may not even have wanted it copyrighted. The publisher may have printed the notice automatically."

"So," Adrian said, "what do we do next?"

"We find the publisher and force him to reveal what he knows."

"The name and location of the author."

Mrs. Farmstead nodded. "And that's what we're going to do. But I've got a question for you: if your suspicions are correct, what does it mean?"

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"I don't even like to talk about it—it's too bizarre."

"Trust me. I've read a lot of bizarre scenarios while I was waiting for customers."

Adrian looked out the window past Mrs. Farmstead. Time had passed, and they were flying over the mountainous northern corner of New Mexico. "I've got a theory," he said, "that Winterbotham, or whoever he really is, was in a position to intercept a communication of extraterrestrial origin."

"From aliens?"

Adrian nodded.

"What kind of communication?"

Adrian shrugged. "Radio. Gravity waves. DNA. Some kind of message, anyway. It may have had some general images or it may have consisted only of the designs. Or Winterbotham may have received or deciphered something that looked vaguely like a spaceship and the engines that powered it, and invented the rest. Only somebody—maybe the people he worked for—didn't want him to publish in some normal fashion, and he had to sneak it out in a way that wouldn't be suspected."

"That's bizarre, all right."

They were silent for a long time, thinking about the bizarreness of their mission.

"The only thing that makes it seem at all plausible," Adrian said finally, "is where we found it."

"And your belief in it," Mrs. Farmstead said.

"There's that," Adrian agreed. "That most of all. Trained people recognize authenticity. There's something about all this that speaks to me."

"Like books and art," Mrs. Farmstead said. "Only sometimes even the authorities fail to recognize fakes."

Adrian nodded. "I didn't say it was infallible. Sometimes wish-fulfillment gets in the way. But there's more: the fact that there may be only one copy. The anonymity of the author. The denial of the publisher."

"The burning of the Book Nook."

"Even if we call that an accident," Adrian said. "My theory is that if the designs are real, aliens have sent us the means to reach the stars."

"Why would they do that, Adrian?"

"That's the question," Adrian said. "And there's no way to get the answer unless we build the spaceship and go visit the aliens. There may be people who don't want us to go. Or don't want the world to have the technology implied by those designs. And they're the ones we need to watch out for."

By that time they were preparing to land in Phoenix, and there was no more time for speculation.

Joel Simpson lived in a small town in northern Arizona. Adrian rented a car in Phoenix. He and Mrs. Farmstead argued about that and the need for Adrian to produce a driver's license, until Adrian pointed out that his name had never been associated with the book or Mrs. Farmstead's store or her telephone inquiries. They had driven north on Highway 17, through deserts and national forests, past Indian reservations, through Flagstaff and close by the Lowell Observatory where much of the world's apprehension about aliens had started with Percival Lowell's observations of the "canals" on Mars and his speculations about intelligent Martians nourishing their dying planet. Adrian wanted to stop, but Mrs. Farmstead vetoed the idea.

"The fewer marks we leave along the trail, the more difficulty anyone will have trying to follow us," she said.

They came to a stop, toward evening, in a little town not far from the Grand Canyon. Mrs. Farmstead wanted to make a side trip to see the gorge carved out by the Colorado River over the ages. "I've always wanted to see it," she said. "I never thought I'd be this close, and I may not have another chance."

Adrian vetoed that notion. "We don't have time. Maybe in the morning." But

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he knew, and she knew, that if their mission was successful they would be leaving in a hurry.

Mrs. Farmstead looked at the town with dismay. There was a business section two blocks long, with a grocery store, an official building of some kind, two filling stations, one with a cafe attached, and several vacant storefronts. This was a town that was being emptied of its citizens like water evaporating from a desert pond. "A town this size," she said, "strangers will stick out like weeds in a flower bed. And all we have for an address is a post-office box."

"We'll stop at one of the filling stations for gas and ask for a motel or a bed-and-breakfast," Adrian said. "Say we're going to head on over to the Grand Canyon in the morning."

Mrs. Farmstead looked at him with admiration. "Nothing like sticking close to the truth," she said.

They chose the nearest filling station. A talkative clerk told them about the best bed-and-breakfast this side of Flagstaff, run by his aunt Isabel and if they told her that Sylvester had sent them, she'd be sure to treat them right. "And give him a fee for touting the place," Mrs. Farmstead told Adrian later. Now she said to the clerk, "Isn't this the place where that fellow publishes those UFO books?"

The clerk looked blank.

"I've read some of them," Mrs. Farmstead said. "Simpson, I think his name is?"

"Never heard of him," the clerk said.

His aunt was more helpful. "Simpson? He must be the odd duck who believes in flying saucers. I've heard he had something to do with books. He lives the other side of town."

"How would we find it?" Adrian asked.

Mrs. Farmstead added quickly, "If we wanted to look him up, maybe say 'hello.'"

"I'd have to draw you a map," Isabel said. "No house numbers in a town like this."

Adrian looked from the map to Mrs. Farmstead. "Thanks," she said. "Maybe we'll drive past there on our way to the Canyon in the morning." She gave Adrian a nudge.

"We're sort of night-owls," he said. "Do you suppose we could have a key to the outside door in case we come in late?"

"A key?" Isabel said. "Nobody locks their doors around here."

Adrian looked at her, astonished.

"How wonderful!" Mrs. Farmstead said. "Come on, dear." They had introduced themselves as mother and son, and now, being maternal and filial respectively, they linked arms and walked out into the narrow street, redolent with the smell of desert wind and cactus. Adrian half-expected to see a tumbleweed rolling down the street.

Simpson's house, if that was what it was, was dark except for a single lighted window, perhaps a study or a bedroom or a living room. The night was black, but they could make out the outline of the building—it seemed square and low, perhaps adobe or imitation adobe. When the light went out, Mrs. Farmstead reached into her handbag and pulled out a flashlight.

"You are resourceful," Adrian said.

"A woman living alone has to be prepared for anything," Mrs. Farmstead said. She led the way to a detached garage.

"We're not looking for a car, Mrs. Farmstead," Adrian said.

"A small publisher can't afford to pay for storage," Mrs. Farmstead said, "and it makes sense to keep his records where he keeps his stock."

The side door to the garage was unlocked. Isabel had been right about doors. They entered quietly, and Mrs. Farmstead played her light around the inside. The only trace of an automobile was old oil stains on the concrete floor and a lingering odor of gasoline. But one

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wall was filled with books on rough shelves; sealed cardboard boxes were stacked against the back wall; on the near side were a gray metal desk, a telephone, a fax machine, and a gray metal filing cabinet.

Adrian inspected the books, and Mrs. Farmstead looked through the files in the cabinet, starting with the bottom drawer. "Simpson was right," Adrian whispered. "There's only two books: *The Aliens Are Here* and *UFOs and What They Mean*. No *Gift from the Stars*."

"Means nothing," she said. "No Winterbotham file either, but then there wouldn't be, would there?" She riffled through the files in the other drawers. "It would take days to go through all these. I've always wondered about movies, how they can come up with the incriminating file in a few minutes."

"Wouldn't there have to be tax records?" Adrian asked.

"Ah!" she said and turned to look for files marked by the year. She chose the one for six years earlier. "Ahah!" she said. "Publishing costs for *Gift from the Stars*, and payment of one hundred dollars to someone named—"

"Peter Cavendish," a voice said from the door. They jerked and turned. A small man in a red-and-black plaid robe over blue pajamas stood in the doorway with a large shotgun in his hand. It was pointed at Mrs. Farmstead.

The garage was redolent with the electric scent of tension, but Mrs. Farmstead stared coolly. "You're very quick to reveal information you've been asked to forget!"

The barrel of the shotgun began to droop. "What do you mean?" the stranger asked.

"Maybe you'd also tell us where we can find Peter Cavendish," Mrs. Farmstead continued.

The shotgun barrel lifted again. "Why would you ask that?"

"The people we work for would like to know how much you'd reveal to strangers."

"You mean you work for—?"

"What do you think? You know what you were told: To turn over all copies of the book and wipe out all evidence of its existence. Well, we've discovered that at least one copy of the book has survived, and people are making inquiries. And now we find, Mr. Joel Simpson, that a record of the author survives in your file."

The shotgun pointed to the stained floor. "I didn't know," Simpson said. He was thin and nervous. "I wish you people would make up your minds—the IRS says I gotta keep the information, you say I gotta get rid of it. What's a guy to do?"

"Bull!" Adrian said, entering the conversation for the first time. "The IRS doesn't care any more. You just forgot."

"Just like you're going to forget Peter Cavendish," Mrs. Farmstead said. "And just to prove it you're going to tell us where he is."

Simpson's eyes got suspicious. "If you're one of them, you know where he is."

"Of course we know," Adrian said. "We just want to know if you know, so that when we tell you to forget it, you'll know what to forget."

Simpson turned that over in his mind without seeming to unravel it. "He's in a mental hospital in Topeka, Kansas," he said.

"That wasn't so hard, was it," Mrs. Farmstead said. "Now forget it! Forget Peter Cavendish! And forget you ever saw us!"

"Yes, ma'am," Simpson said. "You bet. I never want to see any of you again. You're worse than aliens."

"What do you know about aliens?" Adrian asked sharply.

"Nothing!" Simpson said. "Nothing at all! I'm sorry I ever heard of them. I'll burn my books."

"Too much of a giveaway," Mrs. Farmstead said. "Keep everything as it was. Just forget the rest!"

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"Yes, ma'am—and sir."

Outside, in the car, Adrian said. "Quick thinking back there."

"I read a scene like that in a spy novel," Mrs. Farmstead said. "Ian Fleming, maybe. I've read so many I get them mixed up. You were quick on the pick-up."

"Do you think he'll notify anyone?"

"Not for a while. Then maybe the shock will wear off and he'll begin to think about it, maybe wonder why we were sneaking around in the middle of the night, maybe analyze your nonsense about revealing Cavendish's whereabouts so that he would know what to forget."

"It was all I could think of at the time," Adrian said.

"Don't apologize for anything that works."

"Maybe he doesn't have a contact."

"Not likely," Mrs. Farmstead said. "They always leave a number to call in case people start making inquiries or start nosing around. Sooner or later he'll think to check."

"So sooner rather than later we'd better get out of here," Adrian said.

When they got back to the bed-and-breakfast, Isabel wasn't around. She was in her room asleep, they hoped. They messed up their beds to look slept-in, Adrian left money for the night's stay on the end table in the entry hall along with a note Mrs. Farmstead had written saying "Decided to make an early start for the Canyon. Here's money for the rooms. Thanks for everything," and they tiptoed out, easing the door shut behind them.

They headed back to Flagstaff, bypassing the Grand Canyon and the Lowell Observatory once more, before turning east on Highway 40. Mrs. Farmstead dozed in the passenger seat until the sun came up just before they reached Gallup.

"A mental hospital, Adrian?" she said. "I think I was dreaming about mental hospitals and a patient named Cavendish."

"I've been thinking about that, too. But it figures, doesn't it? Where's a better place to stash Cavendish? Where he can talk all he likes about aliens and messages from outer space and spaceships."

"We've got to figure out a plan of action," Mrs. Farmstead said, "and how we're going to protect ourselves."

By the time they arrived in Albuquerque their plans were complete, and all they had to do was to check in the car and catch the first flight to Kansas City. Adrian used their own names again, trying not to glance around the pueblo-style airport to see if someone was watching. "In movies," Mrs. Farmstead said, "people always give themselves away by acting as if someone was watching them. Almost as if they expect to be nabbed, and, of course, they are."

"By now, of course," Adrian said, "they may have traced the license plate on the rental car and have my name. They could be here in a few hours, maybe, but surely not before we've left. I wish we'd thought to make up fake IDs."

"In novels," Mrs. Farmstead said, "pursuers never get thrown off the scent. They'll be waiting for us in Topeka."

"Life isn't a novel," Adrian said. "In a book people get caught because the plot gets more complicated if they're caught, and if the pursuers were thrown off, that would be the end of a story, wouldn't it?"

Mrs. Farmstead nodded. "But it helps to anticipate the worst scenario. That way we won't be surprised."

"We'll have our insurance," Adrian said.

At that moment their flight was called and they passed through the metal detectors and onto the plane, not looking back.

Topeka had three major mental hospitals, the Veterans Administration, the state, and the Menninger Foundation. The first two had developed mostly because of the psychiatrists and reputation

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accumulating around Will Menninger's pioneering work. They weren't far apart, but Adrian thought random inquiries would only tip off pursuers. Maybe he and Mrs. Farmstead could think of a way to narrow the search.

"He probably wouldn't be a veteran," Adrian said.

"But a government agency might be able to put him away there," Mrs. Farmstead said. "Maybe manufacture documents? Pull strings?"

"Possibly," Adrian conceded. They were sitting in another rented car in a large shopping center, having already spent some time in a computer service center. On this occasion Mrs. Farmstead had signed for the car in Kansas City, leaving a different trail to slow potential pursuers. "But government red tape might make it nearly impossible to contact a patient, at least in the time we have."

"Before they catch up with us."

"Or intercept us. As for the state hospital—I don't know the rules in this state, but wouldn't he have to be a resident before he could be admitted?"

"You'd think so," Mrs. Farmstead said. "That leaves—"

"The Menninger Clinic." He glanced at the rear-view mirror and then back at Mrs. Farmstead. "Do you ever feel like we may be fleeing from phantoms?"

Mrs. Farmstead nodded. "The guilty flee. . . ." she said. "But the worst-case scenario—"

"I'm tired of subterfuge," Adrian said. "Let's play it straight."

Ten minutes found them on the campus of the Menninger Clinic. It was an attractive place, not like a hospital or institution at all, with trees and lawns and garden beds and buildings scattered here and there, with the breezes and green odors of a park. In the middle of everything was an office building. After five minutes of winding roads, and half an hour of questioning by security guards, they finally reached a reception desk.

"We're looking for a patient named Peter Cavendish," Adrian said. "We've been told he was hospitalized in Topeka, and we thought he might be here."

"Are you relatives?" the pleasant young woman asked.

Adrian shook his head. "We came across a fascinating book he wrote, and we thought we'd take the chance we might be able to meet him while we were passing through."

"A book?" She turned to her computer and clicked a few keys. "Yes, we have a Peter Cavendish, but you need a written request in advance that must be processed by the resident's treatment team."

Adrian and Mrs. Farmstead exchanged glances.

"Golly," Mrs. Farmstead said, "we're only going to be in Topeka a few hours."

"It might help Mr. Cavendish to talk to someone who has read his book," Adrian added.

"And admired it," Mrs. Farmstead said.

The receptionist hesitated. "Let me call his attending psychiatrist, Dr. Freeman." She turned to her telephone and soon began talking to someone. She swung back to Adrian and Mrs. Farmstead. "What's the name of the book?"

Adrian hesitated and said, "*Gift from the Stars*."

The receptionist spoke the title into the telephone and listened while Adrian's breath caught in his chest. "OK," she said, "I'll get an orderly to take you to the unit."

The building looked like a two-story brick apartment building. Inside, it was like an attractively laid-out and furnished home. They waited in an off-white "day room" with a cream-colored sofa and brown, tapestry-covered easy chairs, framed landscapes on the wall, and a television set in one corner, while the orderly disappeared down a hallway. He returned in a minute or two with a medium-sized man in a dark shirt and slacks and a cheerful Scandinavian sweater; it was white with red reindeer. The newcomer had his hands

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in his pockets. He seemed to be middle-aged, perhaps in his fifties, with blond hair and blue eyes and a calm expression. Adrian wouldn't have given him a second glance on the street unless he had looked closer and noticed the stiff, almost apprehensive set of the man's shoulders and the way his eyes kept scanning the room but never looked directly at Adrian or Mrs. Farmstead.

"Peter Cavendish?" Adrian said. The man nodded.

"I'll be in the next room if you need me," the orderly said.

Cavendish looked after the orderly until he was clearly out of earshot and said, "Are you from *them?*"

"Them?"

Cavendish's glance flicked back and forth. "You know. *Them.*"

"No," Adrian said. "We just came to see you. We read your book, *Gift from the Stars*. We wanted to talk to you about it."

"*They* don't want me to talk about it."

"They're not here. You can talk to us."

"How do I know it's not a trick?"

"Do we look like tricky people?" Mrs. Farmstead said. She leaned forward, her hands spread open as if to show that she was concealing nothing. "I sell books. He designs airplanes."

"And spaceships," Adrian said.

Cavendish looked at them for the first time, and his face relaxed, as if he had been wearing a mask and the fasteners had broken. Adrian realized that Cavendish had been holding himself together. Tears appeared on the lower lids of his eyes. "You've come to rescue me," he said.

"The orderly said you could walk away any time," Adrian said.

"That's what they tell you," Cavendish said darkly.

"But we have come to rescue your ideas," Mrs. Farmstead said. "Could you tell us about the book?"

"It's all true," Cavendish said. Adrian nodded. "We believe it. But what part—"

"Everything. The aliens are here. You may be aliens for all I know." Cavendish's body tensed again.

"We're just people," Mrs. Farmstead said. "Like you."

"That's what they'd say, wouldn't they?"

"I'm interested in the spaceship designs," Adrian said. "I'm an aerospace engineer, and I think I could build a spaceship from those designs."

"Yes," Cavendish said. "I got them out of there, you know."

"From the NASA project?" Adrian guessed.

Cavendish looked puzzled. "From SETI, of course. Cosmic rays. Energetic stuff. Too energetic to be natural, the physicists told me. Figure it out, it makes a picture. Right? You've got to decipher the code. But they make it easy. They want you to figure it out."

"Anti-cryptography," Adrian said.

"But then you don't know," Cavendish said. He looked bewildered. "Do they want you to come? Why don't they come here instead? Why don't the others want the information to get out? What will happen to the world if everyone knows?" He was getting agitated. "Why did they tell us? Why do they want us to come? Do they want to torture us? Dissect us? Make us slaves? Eat us?" Tears began trickling down his face.

"It's all right, Mr. Cavendish," Adrian said. He felt like backing away from the man standing in front of him, looking almost normal but acting strangely.

Mrs. Farmstead had better instincts. She moved forward and put her arm around Cavendish's shoulder and led him to the sofa. She sat down beside him and held his hand.

"Are there any other drawings?" Adrian asked.

"They destroyed them," Cavendish said more quietly. "The other aliens. The ones who are here. The ones who don't want us to go." He glanced around slyly. "But I hid the real ones." He looked

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apprehensive again. "Maybe they're right, though. Maybe it was all a mistake."

A change in the light and a puff of breeze alerted them more than the muffled sound of the door opening behind them. "I think you've talked long enough, Peter," a calm voice said.

Cavendish jumped up nervously as Adrian and Mrs. Farmstead turned toward the door. A tall, sandy-haired man in a tweed jacket and imitation horn-rimmed glasses stood framed in the doorway. He looked a bit like Cary Grant but sounded more like Clint Eastwood.

"Fred," he said, and they turned to see the orderly in the entrance to the hall, "I think Peter has had enough company for one day. Take Peter back to his room and give him a Xanax."

"Yes, Dr. Freeman," the orderly said. He took Cavendish's arm and they disappeared down the hallway. Cavendish gave a single anguished look back at them before he returned to his unnatural calm.

"So," Adrian said, turning to the psychiatrist, "you're Cavendish's physician?"

Freeman nodded. "And who are you?"

"My name is Adrian Mast. And this is Mrs. Farmstead."

"Frances Farmstead," she said.

"We were hoping to get some information from Cavendish about a book he published half a dozen years ago," Adrian said.

"The famous book," Freeman said.

"What's famous about it?" Adrian asked. "As far as I know there's only copy, and we've got it."

"Peter talks about it a lot," Freeman said. "Maybe we'd better sit. We may have more than a little to talk about." He walked into the room and sat down in one of the easy chairs, and motioned Adrian and Mrs. Farmstead to the facing sofa. "You're not casual visitors as you suggested to the receptionist."

Adrian and Mrs. Farmstead looked at each other. Adrian said, "Not casual—in the sense that we weren't just passing through. We sought Cavendish out. But casual in the sense that we represent nobody but ourselves and our curiosity."

"Curiosity about *Gift from the Stars*?"

Adrian nodded. "Do you believe in the book, Dr. Freeman?"

"I've never seen a copy."

Adrian looked at Mrs. Farmstead. She unzipped her large purse, rummaged around in the central pocket, pulled out the book, and handed it to Adrian who passed it on to Freeman. The psychiatrist turned it over in his hands and then opened the cover to the title page and to page one. "Now I believe in it," he said and held up a hand, "though not in the sense you mean. But, more to the point, you believe in it."

Adrian cleared his throat nervously. "At this point I have the urge to convince you that we're not crazy. We're not UFO believers. We don't think aliens are zooming around, abducting people, maybe even passing for humans. But could some of the book be derived from reality rather than imagination?"

"Anything is possible, Mr. Mast," Freeman said carefully. "You can find truth in some unlikely places and, as the French say, even a stopped clock is right twice a day. But this is the sort of book I'd expect a paranoid schizophrenic to write if one wrote a book. Not many of them do; they don't have the attention span. But Peter wrote this book before he came to us."

"And how did he come to you?" Mrs. Farmstead asked. "Was he more disturbed then? Did he have any explanation for his condition?"

"Those are not the kind of questions I feel free to answer. Speaking as his physician." Freeman put his hands together. "You're the ones who need to justify your presence here."

"Turn to the appendices," Adrian said. He waited while Freeman leafed to the back of the book. "Those are spaceship designs. I'm an aerospace engineer, and I would stake my reputation on the

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fact that those designs are genuine. I could build a spaceship from these if I could find something more detailed. And if I could develop the technology they imply."

Freeman nodded slowly. "I'll take your word for it. Not that I believe it. I have no proof, you see."

"Any more than you have proof of Cavendish's—condition," Adrian said. He almost said "insanity" before he realized that psychiatrists probably found that word offensive. "Could it have been induced?" Mrs. Farmstead said. "Is Cavendish on drugs? Was he placed here?"

Freeman shook his head. "He is on drugs, of course. He needs to be calmed occasionally, as you saw just now, and we're trying to restore his sense of reality by restoring his chemical balances. But paranoid schizophrenia is a genetic predisposition sometimes triggered by an emotional crisis."

"Not by drugs," Adrian said.

Freeman chose his words carefully. "He came here talking about aliens and conspiracies, referred to us from a hospital in California. This is a place less conducive to theories of persecution. It was thought he had a better chance of recovery."

"And what if we told you that there may be evidence of a conspiracy to suppress the distribution of this book?" Adrian said. "Maybe Cavendish isn't crazy." There, he had used a word even more likely to offend.

Freeman didn't seem offended. "He suffers from schizophrenia. You can take my word for that—and for the fact that I'm not a member of any conspiracy. I am trying to cure his condition, not cause it." Freeman stood up. "I think you're reading far more into this than is there. Peter Cavendish was a member of a team searching for signs of extraterrestrial intelligence. He had the background and ability to draw these designs, even make them plausible, perhaps even workable. But, like you, he surrendered to his desire that what he wanted to be true was really true. To oversimplify, the conflict created in him by this self-deception, and the necessary supporting details of a conspiracy to keep him from going public, triggered a psychotic reaction that brought him here. When he is able to recognize that, he will be on the road to recovery."

"You mean," Mrs. Farmstead said, "when he's willing to accept your version of reality."

"The world's version," Freeman said.

Adrian and Mrs. Farmstead stood up. Adrian shook his head as if trying to avoid the inevitable. "I hope," he said, "you won't find it necessary to report this incident."

"There is nobody to report it to," Freeman said, "except the team that supervises Peter's case. I have to note your visit, but if I can I won't elaborate on your beliefs. In return I'll need something from you: by your support for Peter's delusions, you have given his treatment a setback, and I would like your promise that you won't disturb him again."

Adrian and Mrs. Farmstead nodded.

"Goodbye, Mrs. Farmstead," Freeman said. "Mr. Mast. Give up this notion. You're only wasting your time."

"Goodbye, Dr. Freeman," Adrian said, "and thanks for your consideration." He reached out his hand. Freeman looked at it for a moment and then, with a start, returned the copy of *Gift from the Stars*.

Adrian sat disconsolately at the counter in the coffee shop, a cup of black coffee cooling unnoticed in front of him. "So Cavendish is crazy, and so are we for chasing after something as weird as this."

"You're taking Dr. Freeman's word for it?" Mrs. Farmstead asked.

"Aren't you?"

"Well, maybe. Freeman could be working for the people who stopped Cavendish's publication, who wanted him hospitalized. But he seems genuine."

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A wicked smile creased her face. "But just because a person is crazy doesn't mean he doesn't have a few sane thoughts. Like Dr. Freeman said about the stopped clock."

Hope flickered in Adrian's eyes. "That's right."

Mrs. Farmstead took a sip of her hot tea. "Dr. Freeman suggested that maybe the stress of writing the book, of inventing what he wanted to be true, set him off. But what if it wasn't that—what if it was the predicament of knowing he had stumbled over some fantastic truth and then it was suppressed?"

"And of not knowing the right thing to do," Adrian picked up excitedly. "Maybe, he thought, the people who wanted to destroy the information were right. Why were the aliens sending the plans? What did they want from us? Why did they want us to have a spaceship that could reach the stars? Why didn't they simply hop in their spaceships and come to visit us?"

"Exactly," Mrs. Farmstead said. "Those aren't easy questions. They might make anyone flip out. That's what Cavendish kept trying to say."

"I'll admit," Adrian said, "questions about the aliens and their motives have run through my mind, too, while I'm trying to go to sleep and sometimes when I wake up during the night."

"And like the bumper sticker when I was young," Mrs. Farmstead said, "'Just because you're paranoid doesn't mean people aren't after you.'"

"But if that were the case," Adrian said, depression edging back, "you'd think that somebody would be tapping us on the shoulder about now."

"Mr. Mast, Mrs. Farmstead," a voice said behind them. "That sounds like a cue."

They turned. Behind them was the orderly named Fred. He had been wearing white pants and a white jacket at the Clinic but now he had changed to a rumpled brown jacket over his white pants, and he looked like a bookish graduate student.

"You?" Adrian said.

Fred nodded. "You know how much orderlies make? They paid me pretty good just to keep my eyes open and let them know if anybody came around asking about Mr. Cavendish. Look, there's somebody who wants to talk to you."

"Suppose we don't want to talk to him?" Mrs. Farmstead said.

Fred shrugged. "Up to you. But sooner or later you're going to talk to him, and the sooner it is the sooner you can stop looking over your shoulder."

"Are you threatening us?" Adrian asked.

Fred spread his hands. "You see any threats? You know, working around a mental institution you get some insights into behavior. I've learned this much: it's better to face the unknown than to run from it."

"And where do we do this?" Adrian asked.

"Is this where some goons throw us in a black limousine and whisk us off to Washington?" Mrs. Farmstead said.

"You been watching too many thrillers," Fred said. "You can go wherever you want, or you can follow me to Forbes Field, where a man has just arrived in an Air Force jet. He's waiting for you."

Adrian looked at Mrs. Farmstead, and Mrs. Farmstead looked at Adrian. Adrian shrugged. "Let's get it over with," he said.

By the time they reached Forbes Field, the sun was setting. It had been a long day that had started far from this spot, and there had been little sleep and less food. They were tired and hungry.

Waiting at the back of an unused hangar at the airfield was a fat man sitting at a folding table. Mrs. Farmstead nudged Adrian and said, out of the corner of her mouth, "Sidney Greenstreet." The fat man didn't laugh like Greenstreet, however, from the gut, his belly shaking. He didn't laugh at all. Sitting behind a portable table, he scowled at

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Adrian and Mrs. Farmstead as if assessing what kind of punishment he could mete out to the civilians who had made him travel all this distance and put up with such discomfort. It *was* discomfort. He overflowed the metal chair he sat on, gingerly, as if it were about to collapse beneath him.

"Well," Adrian said, "then it's all true."

"Truth depends on where you stand," the fat man said.

"Or sit," Adrian said, looking around for other chairs. There were none in that vast expanse of empty hangar. Greenstreet was going to make them stand in front of him like convicts awaiting judgment. "Let's have some truth, then. I'm Adrian Mast, and this is Frances Farmstead, and we've been looking for Peter Cavendish and the alien plans for building a spaceship. Now, who are you and why have you asked us here?"

The fat man was wearing a dark suit. It had a matching vest; nobody wore vests any more, but his had a purpose. He reached into a vest pocket, retrieved a calling card with two fingers, and flicked it onto the table in front of Adrian. Adrian picked it up and looked at it. It read: William Makepeace. And under that: Consultant.

"William Makepeace," Mrs. Farmstead said. "Wasn't that Thackeray's name?"

"My parents were great readers," Makepeace said.

"And what gives you the authority to summon us here?" Adrian asked.

"I'm in charge of the Cavendish affair," Makepeace said.

"It's an affair, then," Mrs. Farmstead said, "like an Agatha Christie mystery."

"An affair," Makepeace said, "is something less than a case and something more than a situation."

"Hah!" Adrian said.

"Let us be reasonable," Makepeace said. "You are idealists; I am a pragmatist. You deal in dreams; I deal in what is. One of us has to convince the other."

"You first," Adrian said. "Are the spaceship designs authentic?"

"As far as I know," Makepeace said. "But I'm no expert in alien communications, nor in deciphering codes, nor in spaceship design. I've been told by those who ought to know that they seem genuine."

"And will they work?"

Makepeace shrugged. It was like a tide of jello under his coat. "We haven't gone that far."

"Why not?"

"That part was unimportant."

"My god! What was important?"

"You want to go to the stars," Makepeace said. "I see that. Sensible people, of whom I am one, want to see that we don't destroy each other. We don't care if you go to the stars, Mr. Mast, as long as we can survive in some approximation of civilization."

"What in the name of everything holy does that have to do with building a spaceship?"

"Nothing," Makepeace said, "but our experts point out that the antimatter collectors—" He stopped as Adrian jumped. "Yes, they are designs for antimatter collectors, according to people who ought to know. If we built them, Mr. Mast, what do you think would happen?"

"Besides getting us to the stars," Mrs. Farmstead said.

"Quite right," Makepeace said. "Besides that."

"I suppose they would lead to the development of new energy systems, maybe generation in orbit," Adrian said.

"You are quick, Mr. Mast. No wonder you caught on to the designs in *Gift from the Stars*. But what comes after energy generation in orbit?"

Now it was Adrian's turn to shrug. "I give up. What?"

"Cheap energy for one thing," Makepeace said. "Our experts predict that we could beam energy down from orbit at a fraction of the cost of current sources."

"What's wrong with that?" Adrian asked.

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"What do you think will happen when entire industries get displaced, virtually overnight?"

"It's happened before," Adrian said.

"But not so quickly, and not in a way that will transform the balance of power. Do you think that the energy-producing nations won't fight, maybe resort to financial strategies that would upset the world's economy, or terrorism, or even war?"

Adrian shook his head. "Buy them off. Buy them up. Cut them in. Give them free energy. Give them a share of the process. Anyway, oil and gas are far more valuable as biological raw materials than as fuel."

"Ah, Mr. Mast, that requires forethought and rational decision-making, and the nations of the world aren't good at those things."

"Maybe they could see that cheap, inexhaustible energy makes everything possible," Mrs. Farmstead said, "from feeding the hungry and housing the homeless to raising their standards of living to the level of the western nations without destroying the world's resources, without pollution. We could clean up the environment. We could do anything."

"Cheap energy could make a heaven on Earth," Adrian said. "It could solve all our problems."

"Mr. Mast, Mrs. Farmstead," Makepeace said pityingly, "that will never happen. People aren't willing to give up their little disputes, their ancient hatreds, their petty jealousies. And, you see, antimatter makes one other thing possible."

"What?"

"Bigger and better bombs. Big enough to shatter this planet, I'm told. Do you have an answer for that?"

Adrian looked down. "No," he said. "You just have to have faith that people are better than that, that they will see the promise and hold off on the destruction. That's your job, you and the people you work for, to convince them."

"I haven't convinced you."

"We're on the side of the angels," Mrs. Farmstead said. "Or the aliens."

Makepeace spread his arms out, palms up, as if helpless in the face of irresistible facts. "But we can't take the chance. Sure we could have a lot more of everything or we could end up with nothing at all. In that scheme of things, the status quo wins every time. So, you see, you have a choice. Either you give up this foolishness or—"

"Or what?" Adrian said fiercely.

"Or we will have to discredit you," Makepeace said. "We can do that, you know. The resources of the government are massive; they can be mobilized to make you part of the UFO fringe cultists. You will be destroyed, along with that book you have in your possession and whatever copies you may have made."

Adrian shook his head. "I don't think so."

"What do you mean, Mr. Mast?" Makepeace said. "I hope you haven't done something foolish."

"Depends on what you mean by 'foolish,'" Mrs. Farmstead said. "You know those old movies where the hero leaves the information in the hands of his lawyer, in case he gets killed, or in a safe-deposit box?"

"Ridiculous," Makepeace said.

"That's what we thought," Mrs. Farmstead said. "They're always killing the lawyer or looting the safe-deposit box, or the newspaper editor is part of the conspiracy. So we put everything on the internet this morning."

"Bah!" Makepeace's relief was clear. "The internet is filled with junk nobody believes."

"We know," Adrian said. "So we labeled the statement as a NASA news release—we didn't know then that it was SETI. But first we inserted the designs into NASA's database."

For the first time Makepeace looked uncertain. "You can't do that!" He shivered as he considered Adrian's confidence. "They can be found, erased."

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"By this time they're all around the world. People must be accessing the database already."

"The designs can be discredited, ridiculed."

"Scientists and engineers will recognize their validity just as I did. Particularly scientists and engineers in other countries. You'll never know who might be taking the designs seriously. As in the race for the atom bomb, the U.S. can't afford to come in second."

"The genie is out of the bottle, Mr. Makepeace," Mrs. Farmstead said. "I think you'd better make your three wishes."

"You poor, stupid people!" Makepeace said. "You don't know what you've done!"

"We've just given humanity the stars," Adrian said. "It's your job to see that humanity doesn't destroy itself first."

"And how do you propose we do that?"

"I suggest you mobilize all those resources you were talking about, get them behind the release of the designs, take credit for it, swing public opinion into the realization that this is a legitimate gift from beneficent aliens, and we have been given the chance to make everybody rich and happy."

"And let some of us go to the stars," Mrs. Farmstead said.

"Oh my god!" Makepeace said and put his face down into his hands. Then, slowly, he pulled himself to his feet and plodded toward the hangar exit like a man who had just realized that he was old and fat and would never feel any better than he did now.

Adrian looked at Mrs. Farmstead. "Well, Frances," he said. He held out his arm and she took it. "I hope I may call you 'Frances.'"

"Any time, Adrian."

"What we opened may be the genie's bottle, or it may be Pandora's box," Adrian said. "Whichever it is, we're going to live in interesting times."

"If it's the genie's bottle, let's be sure we make the right wishes," Mrs. Farmstead said. "If it's Pandora's box, we must remind ourselves to be patient."

And they walked out of the hangar into a night in which the stars seemed close enough to touch.■

Animals can be driven crazy by placing too many in too small a pen. *Homo sapiens* is the only animal that voluntarily does this to himself.

— Robert A. Heinlein

Humankind has not woven the web of life: We are but one thread within it. Whatever we do to the web we do to ourselves. All things are bound together—all things connect.

— Seattle

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Leslie Fish

RUINBORN

Gentlebeings, please! Calm, order, harmony we request! Yes, we will certainly explain the current crisis in sufficient detail that all may fully comprehend. Please—

Thank you, Speaker Plopp. To proceed, if you will direct your attentions to the main screen . . . there.

The Hellworld was originally a common midrange-orbit planet, third in a grouping of ten, that circled an equally common yellow star halfway down the secondary arm of the galaxy. There was nothing remarkable about it when the Vrixx arrived there, some nine galactic cycles past. The planet had developed the usual nitrogen and hydrogen-sulfide atmosphere. Carbon being most abundant there, the planet had also developed the usual first forms of carbon-based life, red-yellow algae being the most advanced. Had the Vrixx not interfered, the biosystem doubtless would have evolved in the usual fashion, culminating with beings like Ourselves, eventually welcomed into our harmony.

Unfortunately, at that time the Vrixx were at war with the Gkh'mer—

Yes, Security-Master Graymottle, this was the Original War of the histories. No, we really do not believe that those archaic tactics will serve us in this instance.

Anyway, the Vrixx had established a strong resistance to the Gkh'mer advance up the major galactic arm, but feared a flanking maneuver into the secondary arm at this particular point. Various scoutcraft had discovered that the Gkh'mer forces were indeed probing

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into the secondary arm and had even established a few base-units there. While Vrixx ships prepared to rout the Gkh'mer from those planets where they had established themselves, other Vrixx ships proceeded to systems ahead of the Gkh'mer advance to fortify the planets there against any further such incursions.

Patience, good Graymottle; further detail is coming.

Most of these systems were lifeless, allowing no economically feasible base for the water-dwelling Gkh'mer—but this planet was the exception, having vast seas of water on its surface: seas filled with the red algae whose products the Gkh'mer could readily process for food.

The Vrixx, hard-pressed for ships and personnel, decided to deny this planet to the Gkh'mer by a simple trick. They mutated large populations of the algae into a new form, blue-green in color, which excreted the corrosive gas, oxygen—

Yes, Scholar Squiggle? . . . Yes, yes, the evidence is overwhelming. If you will consult your personal screen, we will unload there all the data in exhaustive detail. You will note that the local planetary cycle is one 250,000,000th of a galactic cycle. By all means, consider the implications.

Yes, this tactic appears appallingly wasteful to Ourselves, ruining a perfectly good planetary biosphere, but remember that the Vrixx were not only engaged in a war for economic supremacy—and possibly survival—but also that they and the Gkh'mer were the first intelligent species ever to attain spaceflight. To them, the entire galaxy was an open frontier, filled with a plethora of unexploited and useful worlds. Doubtless, they assumed that they could afford to ruin a few minor worlds in distant systems if it enabled them to achieve victory.

—No, good Graymottle, I am *not* criticizing our noble Security forces. We have no interest in the System 2437-A scandal, thank you.

To go on: what the Vrixx did not consider, as their last ship left the planet, was that an oxygen atmosphere might encourage further mutations, and that an oxygen-based metabolism just might be faster and more energetic than one based on normal air.

Yes, good Squiggle, that point is thoroughly covered in the notes. This is not speculation, but observation. Note just how fast these creatures live.

As the Vrixx/Gkh'mer war raged on, its theatre shifted to other locations far distant from the altered planet, and no one kept track of its development. If the Gkh'mer ever even noticed that world, all records thereof were lost in their eventual defeat, collapse, and final absorption. The Vrixx, intent on absorbing the Gkh'mer, became so complacent in their victory and subsequent enrichment that they lost interest in further galactic exploration.

Yes, Speaker Plopp, we all know the historical result: decadence, enervation, retrogression, and finally the collapse of their hegemony into a chaotic collection of worlds whose cultures and biosystems diverged beyond recognition. Certainly, good Plopp, everyone knows the story and has drawn the proper moral conclusions.

In any case, within less than one thousandth of a galactic cycle, the entire civilization of the Vrixx was forgotten—and so was any coherent record of Hellworld.

Meanwhile, in the seas of that lamentable planet, the blue-green algae had not been idle. They did indeed change the planetary atmosphere to a corrosive mix of nitrogen and oxygen, driving the original algae deep under the ocean surface, but they did not thereafter conveniently starve and die out as expected. They mutated again, in such a fashion as to utilize raw solar radiation for energy to assist their metabolism.

That's in section two, good Squiggle.

This in itself might not have been a problem—their numbers increased until

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they surpassed their food supply, at which point starvation should have finished them—but the vile things mutated further.

Some of them became predators.

Please, Squiggle! I will explain the implications at once!

Understand, gentlebeings, that these creatures did not only devour molecules of dissolved minerals nor fragments of starvation-killed viri or bacteria. They actively preyed upon the entire bodies of other living creatures. By various techniques they killed and ate living viri, bacteria, and even other algae. This set the disastrous pattern which was to produce Hellworld as we know it today.

Yes, good Plopp, I'm sure we can all imagine the moral implications.

While the Vrixx were winning their war, consolidating their victory and falling into decadence, the blue-green algae conquered the seas of their planet and advanced upon the land. This, of course, exposed them to stronger solar radiation, which increased the rate of mutation, allowing the survivors to futher exploit the dry surface.

Possibly the most devastating of these mutations was the development of rapid di-sexual reproduction—

Sit down Squiggle!

Yes, this will require some explanation, but is of vital importance, so please bear with me. This mutation produced two distinct and permanent sexes, so that only two individuals—one of each sex—were required for that genetic mixing which we Ourselves normally achieve in group conjugation. Forgive my indelicacy, but our conjugal gatherings—whether in groupings of twenty or a thousand—occur only once every four to ten generations. Try to imagine the effect of exchanging genetic information once every generation. Try to imagine how quickly any successful mutation could thus be spread among the population.

Oh, dear. Our apologies, gentlebeings. We knew the news was shocking, but we didn't expect such an extreme reaction. Did you manage to catch all of Squiggle? How soon can the good scholar be reconstituted?

Excellent. Yes, let's proceed, then.

When the rising empire of the Swree-4 first encountered Hellworld, a full GC later, the planetary biosphere was widely varied, highly active, dangerously progressive and fearfully alien. The Swree-4 were intrigued by this oddity but, being intent on their own expansion and exploitation of their particular galactic zone, paid little attention to it. Almost a hundredth of a GC was to pass before the Swree-4, now at the height of their development, encountered the Gray Plague and began their frantic search for a cure. The search eventually took them back to Hellworld and its bizarre lifeforms.

Precisely what experiments the Swree-4 performed on Hellworld we can never know, the records being long lost. What we can determine is that after this time the first distinct divisions of animal and plant life appeared on the planet. Mosses of wildly varying types developed soon afterward, as did tubular animal forms similar to our own ancestors. Apparently the Swree-4 studied differences in thicknesses of cell walls, and possibly hoped to utilize the technique of photosynthesis in combatting the Gray Plagues.

There is even some indication that they did indeed utilize Hellworld lifeforms to defeat the plague, but that their efforts rebounded on them, producing a second epidemic worse than the first. This would explain both the extinction of the Swree-4 and the presence of light-utilizing lifeforms on several planets in the former Swree-4 zone.

No, no, Graymottle: there is no evidence whatever that the Swree-4 used the Hellworld lifeforms as weapons. Their only enemy at the time was the Gray Plague. Er, good Plopp, how long before Squiggle will be back among us? Thank you.

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To continue: the collapse of the Swree-4 empire introduced a long fallow period into this arm of the galaxy, such that Hellworld was not visited again for another three GC. The next visitors were the philosophical Mngha, whose surviving records note only their observations.

These records show an ominously swift development of the biosystem. The native lifeforms did not proceed down the usual leisurely path of developing a more intelligent worm-form and more productive mosses and algae. Instead, complex plant-forms ruled the land-masses, assisted or preyed upon by countless species of viri, bacteria and algae—many of which, ominously, had evolved into permanent group-forms. In the seas, animals with external skeletons had evolved—often reaching prodigious sizes—and all but the lowest layers of an extensive food-chain were predatory . . .

Ah, Squiggle! How good to have you back among us. Yes, the notes are on your screen. We hope you were not too seriously discommoded.

But onward. The dominant lifeforms were horrendously complex animals whose internal fluids were pumped through immensely complicated piping systems by an organ which never rested. Their bodies were surrounded by thick skeletons of stoney armor. Their amazingly evolved digestive systems originated in orifices lined with bony projections as hard as stones, called "teeth," which were devised for nothing less than assaulting and mangling the flesh of other lifeforms.

Er, steady on, gentlebeings. Remember, it's only a projection.

The Mngha seem not to have noticed anything worrisome in these developments, for they simply took notes and passed on. The meeting and eventual merging of the Mngha with the more vigorous Xshan occupied both species for at least another GC, and nearly as much time was required for their descendants to regain the level of their ancestors' development.

When their ultimate descendants, the Ghanx, contacted Hellworld again they discovered striking changes.

In the oceans, creatures with internal skeletons had developed, some of amazing size, with bodies clad in an exterior armor of scales and mouths armed with ever more efficient teeth. Possibly in flight from these sea monsters, exoskeletal animals had come onto the land and were busily exploiting its vegetable resources. Some of them actually displayed group organization and social instincts, which only made them more efficient at ravaging other lifeforms. The land was a stew of predatory life, the seas were a soup of it—and even the atmosphere was thick with hungry, active, ferociously fertile beings.

The long-lived and patient Ghanx studied the biosystem for a good hundredth of a GC, and observed fearsome changes in the biosphere even as they watched. Their surviving records mention endoskeletal lifeforms emerging from the seas to exploit the land, and of course, preying on the exoskeletal animals which had arrived before them. They also saw the descendants of these amphibians increase in numbers, size, and predatory efficiency.

At this point the Ghanx quarantined the planet and placed warning buoys around the entire system. These warnings were dire enough that no one came near for the Hellworld system for almost another GC.

Alas that no language or lesson lasts forever! Eventually the descendants of the Ghanx, whom we call the Ghanx-II, although they bore little resemblance to their ancestors, came upon the Hellworld system. Either ignoring or failing to comprehend their ancestors' warnings, the Ghanx-II approached Hellworld and studied its biosystem. By now the amphibious life had thoroughly conquered the land surfaces, had developed

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countless species arrayed in a complex chain of predation, and showed signs of evolving to still larger and more complex forms.

Understandably horrified by this spectacle, the Ghanx-II made an unfortunate attempt to cleanse the planet.

Intending to turn the biosystem's own predatory nature on itself, the Ghanx carefully developed and then released several predacious forms of viri, bacteria and algae onto the planet. At first these methods seemed successful; great numbers of Hellworld plants and animals died, on land and sea. Whole families of lifeforms vanished. The teeming life of the planet thinned. . . .

Er, yes, Squiggle. The dominant lifeforms had been a family called the "therapsids" by Hellworld's current inhabitants. This family was experimenting with further developments in internal-communicative organization. All but one species were exterminated. Unfortunately, this allowed the rise of another family of predators, called "reptiles."

Yes, the Ghanx-II had underestimated the mutation-spreading efficiencey of disexual reproduction. Also, preoccupied with the biosystem's overwhelming tendency toward predation, they quite overlooked the almost equally vigorous trend toward symbiosis. The local algae, now developed into a new voracious fungal form, were swift to exploit the altered new microforms as a foodsource. When ingested by the local plants and animals, these fungi often survived for a time in the devourers' bodies, where they continued to happily slaughter invading plague bacteria. Also, plants which developed resistances to the plagues were often eaten by animals who then developed resistances themselves.

In brief, the attempt not only failed, but backfired. The Ghanx-II gave up any further attempts and fled the system, leaving another array of warning buoys as they went. Eventually, their whole race fled the galaxy for realms unknown.

Ghanx-II technology being what it was, the buoys performed faithfully for almost a tenth of a cycle thereafter, but later began to fail. By the time the Ssthan began exploring the region, the last buoy was silent. If the Ssthan ever encountered any of the buoys they did not succeed in translating the bedded memories and extracting the warning message, for they proceeded into the system and inevitably encountered Hellworld.

Yes, Speaker Plopp, they did indeed come to some socially relevant conclusions.

Surviving Ssthan records are filled with their horrified observations. Plant forms had proliferated to dizzying numbers, unbelievable complexity, and astounding size. Animal life had diversified beyond comprehension, varying in size from creatures comparable with Ourselves to impossible giants of a thousand times our mass. The dominant forms now sported scale-armored skins, much thicker than their ancestors', and their internal pumps had evolved to highly efficient three-chambered organs. They also developed powerful limbs, tipped with scalelike "claws," to match the further development of their teeth.

No, Graymottle, we would *not* recommend reconstructing such beasts for use as weapons.

Worst of all, in developing complex sensory devices, the creatures had also evolved internal cybernetic systems which—dare we say it?—displayed the precursors of intelligence.

Yes, we see that you comprehend. Please, this is no time for another collapse, Squiggle! Stiffen your upper palps, gentlebeings; there is worse to come.

Yes, the Ssthan, no less than Ourselves, could extrapolate the horrifying vision of these predatory creatures achieving intelligence, science, spaceflight, and finally advancing out upon

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the galaxy in only a cycle or two. Yes, the Ssthan, no less than we, felt sufficient responsibility to future generations to prevent such an appalling event.

Having no access to the Ghanx-II records, the Sstahn likewise experimented with plagues—and with no better success. Unlike the Ghanx-II, the Ssthan did not abandon the problem and flee. No, they were made of sterner slime than that, and they tried sterner measures which we cannot entirely condemn as wasteful.

Correct, good Graymottle; they attempted bombardment.

The fifth planet of the system was a cold and barren globe of nickel-iron and silicate rock. The Ssthan exploded it, creating an asteroid belt between the warm inner planets and the outer gas giants, They reasoned that the inevitable orbital decay would bring a constant rain of meteors onto the inner planets, including Hellworld, and that this bombardment would eventually destroy all complex life on the planet. The fact that the belt of asteroids could also then be efficiently mined for valuable metals was merely a secondary consideration.

Unfortunately, the meteor-rain did not succeed. The Ssthan, being used to a thin atmosphere, had little experience with the uses of a thicker atmosphere—let alone the corrosive properties of oxygen—for planetary defense.

Graymottle, it's a bit late for trying that tactic Ourselves.

From their safe position in the new asteroid belt, the Ssthan only noted the occasional brightness of a meteor-strike on the inner planets; they were too preoccupied with their mining efforts to investigate. Thus, for many local orbits they failed to notice that the light-displays were not the result of impact with planetary surfaces but the effect of meteors burning up in the atmosphere.

Yes, Squiggle: *burning.* That is what oxygen does.

Perhaps the Ssthan may be forgiven for their unwillingness to investigate Hellworld too closely, but the effect was that a millionth-GC passed before Ssthan expeditions discovered that the bombardment had failed. Hellworld was marked but lightly, if at all, and its ferocious biosystem continued to evolve horrifying lifeforms at shocking speed. There was even evidence that the fine mineral-rich dust of the burned and pulverized meteors had invigorated the diet of the plants and microlife.

Please, good Plopp, there is no time now for a lecture on the virtues of vigilance.

At this point, perhaps due to economic and political pressure from the rising R'twy Federation, the Ssthan threw their entire local mining-fleet into an effort to steer an asteroid of suitable size toward impact with Hellworld.

Yes, Graymottle, they *did* succeed—for what good that does us. Despite the amount of mass it lost to Hellworld's atmosphere on descent, the records show that the asteroid made a most satisfactory impact. The planetary rotation was altered, the magnetic poles shifted, axial tilt increased, and the entire surface of the planet was blanketed by thick clouds for several local orbits thereafter. Examination flights reported all the giant dominant animal lifeforms extinct, and several plant species as well. The planet's entire surface was chilled, with water collecting as ice at the poles. It should have been enough.

Assuming that all Hellworld life would soon follow the giants to extinction, the Ssthan congratulated themselves on a job well done, collected the last load of metals from the asteroid belt, planted a few warning buoys of their own, and headed back to the Ssthan home system in preparation for the great Ssthan/R'twy War.

No, Chief Graymottle, I shall summarize that conflict quickly.

The unfortunate war laid waste to much of the primary galactic arm, ruined both civilizations, reduced the survivors to a retrogressive barbaric rem-

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nant—and guaranteed that no one would rediscover Hellworld for another tenth of a cycle.

Yes, Speaker Plopp, an excellent example of the wastefulness of war. No, Chief Graymottle, we don't believe that the Ssthan/R'twy techniques will help Our present situation. Pray let us continue.

Eventually, the cyborg civilization of the R2C encountered Hellworld. It appears that they spent most of a thousandth-cycle simply studying the planet, and their proverbially clear records give exhaustive accounts of what they found.

The biosystem of Hellworld had not died, but only mutated again. The giant reptiles had indeed lost their domination of the planet, but the descendants of the last of the therapsids, if you please, had regained the position that their ancestors held before the Ghanx-II Slaughter. The dominant animals now sported four-chambered bodily fluid pumps, skins covered with flexible heat-insulating filaments, a bizarre but highly effective method of internal reproduction, a complex system of feeding and protecting and actually training the young, and a cybernetic system perilously close to achieving sentience. And, of course, they all preyed on each other, endlessly and with horrifying efficiency.

The R2C were incapable of experiencing horror or dismay, but they drew the logical conclusions. They studied the available records of previous attempts upon Hellworld, and tried a periodic alteration of its weather.

What, Graymottle? Their technique? Well, it required the exploding of a small star within a dust-cloud, but the R2C managed to rain enough cosmic debris on Hellworld at every thousandth-GC to guarantee a regular chilling of the planet. This chilling, they noted, caused the caps of water ice at the poles to grow and advance over the land masses, while subsequently lowering the sea levels, once per thousandth-cycle. This, they presumed, was often enough to scour the land clean without disturbing the deep sea bottoms where proper red-yellow algae still survived. At this time, the R2C were still taking the long view. They planted a few monitor satellites and departed, doubtless intending to return in a hundredth-cycle or so to observe how well the plan had worked.

Yes, Squiggle, it should have worked. It had a hundredth-cycle in which to work. It didn't. Do you need more liquid refreshment?

But to go on: unfortunately for the R2C—and for Ourselves—it was shortly after this effort that the entire R2C civilization became entranced with the fool Energetic Philosophy. We all know the result of their subsequent attempts to become beings of pure energy; our ships still encounter areas in space where the radio noise and molecular debris of organic origin cluster in measurable amounts. . . .

Er, Speaker Plopp, we certainly agree that this illustrates the wisdom of remaining in the natural forms which the Great Egg gave us, but there are certain limits of the flesh which we must consider quickly.

Thank you.

It is often said that the departure of the R2C opened the galaxy for the rise of Ourselves, but now there is reason to wish that the R2C had delayed their departure for a thousandth-cycle more. They could have properly finished the job with Hellworld instead of leaving Ourselves to inherit their problem...

Please, please, gentlebeings! Squiggle, you're not about to liquefy again, are you? Chief, do remember that Plopp *is* our Supreme Commander. Good Plopp, this is no time to argue the merits or sins of R2C technology. Please!

Now, concerning our contact with Hellworld: our ships first encountered the planet and its fearsome creatures a mere thousandth of a cycle ago, by which time the survivors of the R2C cleansing attempt had already attained rudimentary intelligence. They were still

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very primitive technologically, which lulled our first study teams into thinking we had more time in which to deal with the threat.

No, good Plopp, I am not making excuses. I wasn't even on the initial survey team. I am simply reporting the undeniable facts. Thank you.

Yes, we spent the time observing the planet and studying all available records left by previous civilizations—thanks largely to the record-keeping efficiency of the R2C—but during even that period the dominant animals, "humans" as they presently call themselves, increased their intelligence and developed to the first use of pictographic art.

This, as you may imagine, set off alarms. Our best scientific groupings were dispatched at once to find solutions. Because of Hellworld's position near a major trade nexus—not to mention Our economic predicament—we simply could not afford to explode the planet, let alone its home star. Other methods were required, and be assured that we used them all.

Yes, Squiggle, we tried plagues—but the humans adapted. Worse, the experiences encouraged them to study other lifeforms on the planet in search of curative chemicals. This led them into knowledge not only of medicine but of general biology as well, which only spurred their development of science.

Yes, Graymottle, we tried altering the planetary weather. In response, the humans became extremely mobile, and betook themselves off to other areas which had profited from the changed weather patterns. Worse still, they learned how to domesticate the local animals and improved their knowledge of primitive ship-building to facilitate transportation. Worse, they developed knowledge of metals.

In desperation, some five thousand local orbits ago—look it up on your screens—we instigated a massive shift of the plates in the planet's geological crust. This caused extensive earthquakes and volcanic eruptions, with all the ecological disturbance that entails, in those areas where the humans had developed their civilization to the highest degree. These upheavals continue to trouble the area, in unfortunately diminishing force, down to the present time—but they did nothing to retard the growth of human civilization, The beasts simply moved away and started over, somewhere else.

Yes, Speaker Plopp, it was at this point that we attempted sociological disruption. We had noticed that the geological upheavals had encouraged bizarre social behavior among the humans, and considered that where force had failed social engineering might succeed. Yes, we commend your buddling, Splatt, for his activities in this area. If we had only been successful in this endeavor—

It was no one's fault, Plopp! We threw our group wholeheartedly into this effort. If any doubt that we made prodigious efforts in this area, let them consider our attempt in detail.

Shut up, Graymottle! This is important!

In the centers of human civilization—subtropic zones near oceans and large rivers—human awareness of their own di-sexual breeding process was largely unknown, which is not surprising when one considers the bizarre complexity of the process. Females were assumed to conceive young by themselves; thus, the only known parent was female, all inheritance of goods or status passed in the female line, and the female was predominant in social interactions.

We targeted these particular societies because the economic base of their cultures was fishing, farming and primitive manufacture. They were settled, peaceful—for Hellworld creatures—rarely warred, imagined primarily benign female deities, and produced enough surplus food to support a class of scholars.

These scholars were dangerously engaged in studies of primitive science. They had progressed to the beginnings

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of literacy and a knowledge of the readily accessible metals: gold, silver and copper—and they were beginning to experiment with bronze.

Yes, Squiggle, we *did* assume that the scholars were the most dangerous class of humans. That is precisely why we targeted them and their support network.

Fortunately for our purposes, to the north dwelled barbaric cultures based on hunting and herding. From observing their herds and flocks, these cultures knew about the necessity of the male for breeding; therefore inheritance passed in both male and female lines and both sexes took equal precedent in society. They were nomadic, often warlike, worshipped male and female deities equally, had very few scholars, had no metals nor knowledge of how to produce them, rarely produced surplus food, and often exported excess population to the southern cultures.

Actually no, Speaker; these cultures were not in conflict. The northern immigrants were usually assimilated smoothly into the southern cultures. Their knowledge of breeding was slowly spreading through the southern population, and males were beginning to rise toward an equal status with the females. If not interrupted, this process would have led to a gradual blending into an ambiarchal culture with the skills and knowledge of both peoples. That would have made a culture competent at warfare but more interested in trade, producing reliable surplusses of food—therefore supportive of scholars and developing scientific knowledge to dangerous levels.

We prevented all that.

By simple tricks—such as projecting messages in the barbarians' own languages, causing spectacular explosions and fires, and occasionally projecting holographic images—we accomplished four significant changes in the northern culture. We encouraged the primacy of the male in all social interactions, encouraged warfare as a primary social function, taught the barbarians the production and uses of bronze and iron—especially for weaponry—and, with the help of a little weather alteration, sent the barbarians southward to attack the scholars' cities.

Yes, Speaker, it did work—at first. The resulting social chaos was truly satisfying. The remaining cities now had patriarchal barbarian rulers and a resentful matriarchal underclass with racial, religious and cultural differences further dividing them. This guaranteed constant internal social strife for the next 200 generations, at least.

Unfortunately, this did not eradicate science nor reduce the value of scholars. Even the most stupid barbarian could see the value of study and research, at least in the areas of medicine, weapon making, and increased agricultural yields. We were obliged to try again

We used all the expected tactics: killing off dangerously progressive leaders here and there, plaguing and poisoning progressive civilizations, ruining and breaking more enlightened empires, and so on. These setbacks only delayed human progress, at best; thanks to their distressing mobility, some humans would always escape whatever wreckage we wrought, and would go inform others elsewhere of their troubles and what caused them—as well as passing on their skills and successes. Obviously some serious cultural/intellectual poisoning was required, and after sufficient study we thought we had found a useful one.

Yes, Graymottle, we *did* use social science as a weapon. Yes, it did succeed—after a fashion. It certainly failed no worse than previous methods.

But to continue: as stated, we noticed that our geological upheavals and assorted plagues had caused a plethora of superstitious behaviors and imaginings among the humans, who then created a multitude of bizarre deities to explain the phenomena. We chose the most dis-

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astrous and irrational of these deities, and actively encouraged their worship.

By feeding visions, voices, occasional "miracles"—and considerable military information—to the chosen priesthoods, we soon had the civilized populations of Hellworld worshipping deities who promoted sexual, racial, economic, and cultural divisions. These deities further exalted war, demanded blind obedience, encouraged humans to hate and fear their own natures, and—above all—distrusted rationality and discouraged the development of science. This, we calculated, would keep humans ignorant, divided, afraid to breed and eager to slaughter each other until they wiped themselves out.

Unfortunately, we underestimated the persistence, ingenuity and downright fearlessness of human greed. To obtain goods, which could purchase not only comfort but status, humans were quite willing to sneak around their gods—or at least around their priests—and further the study of practical sciences. Also, thanks to the constant presence of those previously-seeded plagues, the study of medicine—and therefore biology—never became unpopular.

Don't smell so smug, Squiggle. It doesn't end there.

Equally troublesome was the powerful human instinct to breed. Despite our best efforts, very few priests ever seriously considered the idea that humans should stop breeding entirely and await their reward in some afterlife. Neither did our most heavily inculcated fear of mating cause humans to stop doing it. They might abuse their mates, their children and themselves, they might indulge in some truly amazing perversions, but humans would still mate—and therefore breed.

At this revelation, an argument developed among our operating teams. . . .

Er, no, Speaker. I don't recall which side of the argument Splatt took.

One group held that we should continue inculcating sex-fear and war, in the hope that this would encourage more abuse, suicide, murder and war among humans. Others held that we should actively encourage peace, trade, manufacture, consumption, and especially breeding so that the humans would overpopulate their food supply and starve themselves—and hopefully their entire hideous biosystem—to extinction. Experiments were duly conducted, encouraging the two different systems among separate populations.

Whether these experiments would have borne fruit is now a moot question, since the populations didn't stay separate. Human greed, again, caused exploration for trade or conquest—and in either case the result was the same. When the two cultures met, one would subdue the other, loot it, and then—having gained a taste for the particular goods and services it had looted—would demand more of the same. This always encouraged manufacture and breeding among the subjugated. This, in turn, inevitably led to trade. Along with goods and services went ideas.

This led to a ferment of contesting ideas among both cultures: sex-fear versus sex-worship, overbreeding or underbreeding, war or peace, asceticism or consumption, this deity or that, matriarchy or patriarchy, and so on. At first we happily encouraged these arguments, hoping that the humans would use them for cause to slaughter each other—which, indeed, they often did.

Unfortunately, such contests often settled the arguments. Worse, the arguments often led to a synthesis of ideas that allowed for more tolerance and encouraged rational thought. Worst of all, none of these battles in any way discouraged the humans from developing their science. If anything, the scholarly class of humans was encouraged to work toward the development of spaceflight in hopes of escaping the troubled planet.

Yes, Graymottle, we did something. If you will recall, gentlebeings, we first requested permissions and materials suffi-

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cient to explode the Hellworld home star. Then we requested permission and materials sufficient to explode the planet itself. Finally, we requested sufficient ships to help us divert several large asteroids onto collision course with Hellworld. All of our requests were denied, if you please, because all available ships and materials were busy dealing with the System 2437-A Unpleasantness. If memory fails you, we have copies of the requests and refusals—

Yes, to proceed with all due haste: less than a hundred local orbits past, humans began seriously undertaking spaceflight. At this appalling development, having no resources but our own, we redoubled our efforts to stamp out this dangerous idea, as well as any developments or attitudes which might encourage it. In our desperation we sometimes neglected caution, and all too often humans caught sight of our scoutcraft. Despite our best attempts to denigrate this evidence—and the humans who presented it—the concept of space-going machines spread among the humans.

In a last-ditch effort to prevent exploration of this concept, we raised up some particularly lunatic tyrannies among the major civilizations and launched them into what we hoped would be total, and final, war. We went so far as to encourage the development of atomic energy during this conflict—

Yes, Plopp, we knew the danger! It was our considered expectation that introducing this knowledge in the midst of a planet-wide war would encourage the humans to use it for weapons against each other. We calculated that the humans would then sterilize the planet for us—or at least ruin its biosystem so thoroughly that any survivors would be obliged to spend the next GC struggling for simple survival.

Er, yes, good Squiggle, the plan did succeed . . . up to a point. The humans did develop atomic weapons and did use them—but only twice, on two cities, which rather decisively ended said war.

In fact, despite our best efforts, humans never again used atomic weapons in war. Their biosystem has suffered worse from occasional atomic accidents than from deliberate use. If anything, those incidents made humans more cautious with the use of atomics—and then, by extension, cautious with anything that could damage the biosystem. Within fifty local orbits the humans had developed an awareness of and concern for the safety of their biosystem, thus undoing centuries of hard work by one of our best social-engineering teams—yes, which included Splatt.

None of this discouraged the humans from their desire to achieve spaceflight.

Toward the end of our project, we gave up all hope of stopping the humans and only tried—frantically—to instill in them the ideas that predation is evil, that truly intelligent beings would not devour the bodies of any living creature (although that would, in fact, leave them with no source of nourishment but synthetics), that social progress is entirely too fast and that humans should return to simpler technological levels, and that mergence and absorption are the proper modes of social interaction.

We did not even try to instill the ideas that teeth were cruel and unnecessary, and that oxygen breathing might have serious drawbacks.

No, Plopp, that didn't work either. Our attempts only resulted in a few barely-significant politico-religious cults, a rise in meat prices, and more accidental sightings of our scoutcraft.

Worse, thanks to human progress in medical studies and development of mechanical cybernetics, specimens whom we picked up for testing and later returned to their home environment developed means to shake off our memory-blanking techniques. Despite official denials, humans grew increasingly aware of us and of our . . . meddling.

Yes, good Plopp, I'm certain that had

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you been there you might have thought up some scheme to dissuade the humans. Unfortunately, none of us had your expertise in political technique—not even Splatt.

In any case, that last factor thoroughly undermined one of our few sucessful projects. For countless local orbits we had inculcated worshipful obedience to authority—and then insured that said authority would be addicted to its political power, fearful of any social change which might threaten that power, and thus inimical to progress in anything but weaponry and social control. Now, thanks in part to so many sightings of our ships being denied by various governments, humans came to distrust not only said governments but all authority in general. Admittedly, we stumbled over our own pseudopods on that one.

In short, nothing worked. Within thirty local orbits of that insufficiently disastrous war, humans achieved simple spaceflight and set foot on their own moon. After that, we could do nothing but attempt to delay the inevitable. Economic disruptions, wars, plagues, droughts, volcanos, earthquakes, attempted meteor strikes—none of them slowed the humans' explorations of science or stopped their rush into space.

When they landed colonizing ships on the fourth planet, we judged it prudent to retreat to the farthest planet in the system and observe from there. Less than ten orbits after settlement, the humans made an unforeseen discovery. What we heard of it from their radio-broadcasts—admittedly slow to reach our listening-post—caused near panic among our study teams.

Yes, Squiggle, that was when we started sending those desperate communiqués which you, gentlebeing, dismissed as hysterical. Reconsider those messages now.

Having never seriously studied the fourth planet, we never realized that an ancient Ssthan warning-buoy had crashed there sometime in the distant past—or that the smaller moon hosted an R2C monitor satellite. Ssthan construction being notoriously sturdy, and the fourth planet comparatively barren and lacking weather, the buoy had survived almost intact—complete with its functioning memory, which included all the service manuals. Worse, the R2C satellite was completely intact—along with its capacious memory and translations of the earlier Ssthan records.

Bad enough that the humans now had proof that intelligent life existed elsewhere in the galaxy. Worse, within forty local orbits the humans had translated the manuals, studied the buoy and satellite down to their molecules, and learned the secret of faster-than-light travel. Worst of all, they translated the warning messages and histories.

Squiggle, this is no time to liquefy! Graymottle, it's far too late to send ships to explode the humans' home stars; they can see the fleet coming and stop it. Yes, stop it! They are fast-breeding, fast-living, fast-learning and they know far too much. Oh Plopp, *do* shut up! You haven't heard the worst.

Yes, worst.

I hesitate to describe the humans' reactions to these revelations. Suffice it to say that they are, on the one tentacle, grateful that alien interference made their world the oxygen-breathing, predatory, life-teeming world that it is. But on the other, they are extremely . . . irritated at the way we have manipulated them since they achieved sentience.

No, no, of course they found no record of any direct interference since the R2C placed their lamented satellite, but they have re-evaluated all those accounts of "alien sightings," and have inferred much.

Worse, they interpreted the histories wrong. They assume that the R2C were only the robotic servants of the Ssthan, and that we, whom they have occasionally seen and remembered, are these same

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Ssthan who tried to destroy them in the past. They presume that we Ourselves are their ancient tormentors. We gave them the concept of a Devil, an Ancient Enemy, and they assume that it is us.

They have faster-than-light spaceships. They have traced and translated our system's radio signals. They are, as they put it, "pissed off."

And they are coming here.

Their first fleet was launched two local days ago, and there is no doubt of their destination.

We can only recommend a species-wide retreat to the other side of the galaxy. There is still some hope that the suitability of many intervening worlds for their colonization will distract them long enough that they may, in their volatile way, forget about us. If we can hide from them long enough, they may possibly evolve into a lifeform that feels no need for a predator's vengeance—

Gentlebeings, please! Panic will avail us nothing; we must retreat in an orderly fashion!□

IN TIMES TO COME

The lead novelette in our October issue, with a dramatic cover by Randy Asplund-Faith, is Paul Levinson's "Late Lessons," a sequel to his award-nominated "Loose Ends" and "Little Differences"—but you don't need to remember them to understand and enjoy the new story. If trying to deceive creates a tangled web, trying to improve history is far worse—and some of the crucial lessons, as the title suggests, take a while to learn.

We'll also have something for the season from Ramona Louise Wheeler, a new "Astral Astronauts" tale from Jerry Oltion, and other fiction by such writers as Sarah Zettel, Laurence M. Janifer, Christopher McKitterick, and a couple new to *Analog*.

The fact article, by William Walling, is "You Are Here!," about a technology many of us have used, directly or indirectly, but few understand in detail. It's a direct product of our ventures into space, and it makes life much easier for its users—but that certainly doesn't mean it was simple or easy to develop!

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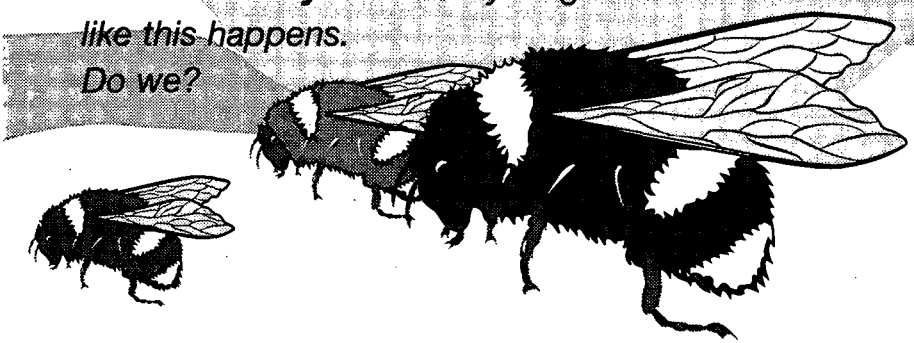
Kandis Elliot

TCoB

*We don't **really** believe anything like this happens. Do we?*



"Nice bees, pretty bees," cooed Professor Gabrielle Oates. "How are my girls today, hmmm, bee bee bee—" Her heavy coverall sush-sushed around her old bony frame as Professor Oates cautiously circumvented a humming box in the center of the small lab. She moved slowly toward the wall feeders as bees making their incessant trips from feeders to hive and back darted past her hooded head. Like dark snowflakes in a white world, the insects punctuated every cubic meter of the room, exploring the lab's concrete walls, inspecting the sealed lightbanks, testing the heavy screen over the drainage channel in the floor.

"Bee, bee, bee, bee," chanted Professor Oates. She approached the plastic feeders just close enough to note that they were clean and full. Daily care of the bees was wholly performed from outside the lab, but the Intruder Reaction test required a volunteer. Professor Oates herself was happy to do it. Above her sincere belief in the importance of her work, she possessed an affection of a higher order, almost motherly, for the research organisms themselves. Adjusting her stance to accommodate her arthritic hip, she took a few moments to enjoy watching the bees sip their various liquid offerings. Without close application of a hand-lens, the insects appeared to be ordinary honeybees: furry, golden, busy. Not too busy to take notice of Professor Oates, however; each passerby stopped in mid-flight to aim faceted eyes for a brief, wary inspection of the bundled-up intruder. An undulating tan frosting began to cover the white of her sleeves and inch over the slick surface of her hood visor.

"Nice bees, that's my girls, you know me now, don't you, my *good* bees, *pretty* bees—" Professor Oates tiptoed back toward the multi-tiered hive. She delicately stretched out a bee-coated glove and tapped an upper section. The ominous humming grew loud and high-pitched.

"Nice bee, bee, bee . . . goddamighty!" The hive erupted with a roar of golden bodies. Professor Oates whirled and, protesting joints notwithstanding, sprinted for the door. The clouds of en-

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raged bees, joined by others that had been exploring the multitude of chrome jets paralleling the doorjambs, were blown backwards as she hit the Air Pressure button and ducked out.

"'Bout time for you bloodthirsty little devils to invade New Jersey," Professor Oates muttered as she swatted obstinate individuals retaining sting-holds on her coverall. The multitude of stings had transformed the smooth fabric into a cloth rasp. One overlooked bee emerged from the hood-mesh as she hung up her gear; it flew straight to the back of her neck.

"Ow! Ow! *Ow!* Gol-*darn*-nit!"

Uttering further inspired expletives, she retreated from the Bee Room antechamber; nonetheless, as she leaned against the outer door and rubbed the forming welt, Professor Oates chuckled quietly. With a philosophical shrug she started off toward the Concussed Monkey Facility and Purple-Eyed Mouse colony.

She had taken but three steps when the yellow 'Message' light down the corridor began to beckon. With an apologetic glance at the still-uninspected rooms, she turned and headed for the security doors.

"An inspector from National Science Funding is here, Professor Oates," said the young man at the reception desk. "Looks tight-fisted enough to pinch the head off a nickel. I put him in your office and gave him coffee."

"Thank you, Johnny," she said. "About time those slaggards sent someone. I've had the demos ready for weeks."

She paused a moment outside the door to salvage her snowy coiffure, then squared her shoulders and entered her overflowing office. A moment's search located a sour-faced man surveying her library of technical books. "Hel-*lo*," she greeted sweetly. "I'm glad Fund had you come so *soon!*" She held out her hand. "Gabrielle Oates. Please sit down." She removed a stack of research journals to reveal a chair.

"Roy Perkins. NSF Clearance Department. Here about your grant request for basic research projects." Despite suit and bowtie, Perkins looked more tag-team wrestler than bureaucrat. He sat and parked an ominous black briefcase on his knees.

"The projects, yes indeed," Professor Oates nodded, easing her retirement-age bones into her well-padded desk chair. "Give us that two million, Mr. Perkins, and I assure you that Biotek Institute will reward modern science a thousand times over."

"Tell you up front that times are tough for grants," said the inspector. "Cancer and AIDS getting the biggies. Haven't been funding these little technology projects."

Professor Oates smiled confidently, aware that many a desperate hard-sell speech by struggling researchers had rolled off the experienced back of Inspector Perkins. "Biotek's business, as we like to say, is taking care of the business of science. Our projects can be immediately applied to research currently being done at other institutions—several now being funded by you, I might add."

"Let's review Biotek's business then," he said with a you'll-never-convince-*me*-sister expression, and pulled several paper-clipped documents from his briefcase. "Central project deals with development of a new agar." He flicked a skeptical eye. "Heard no complaints about the *old* agar." Perkins slurped his coffee. Ball's-in-your-court, said the eyes.

The professor fished among journals, books, an assortment of beakers and test tubes on her huge, overflowing desk, and finally handed the inspector a covered, flat glass dish half-filled with opalescent goo. "When labs test *our* agar," she pointed to the dish, "they will find the old as obsolete as dinosaur omelettes. *Our* agar," she said with a carefully measured mix of smugness and humility, "is *programmable.*"

The inspector narrowed his eyes at

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the palm-sized dish and its contents. "C'you be more specific, Professor Oates?"

Gabrielle Oates dialed her Grandmother Charm up to maximum. "Let me be an open book, Mr. Perkins."

With an if-you-please she took the dish and herded inspector, documents, and paper clips through the maze of corridors and laboratories that was Biotek Institute. Workers in white labcoats exchanged warm greetings with her as she passed. The inspector had forgotten the agar dish by the time his hostess stepped into a small workroom paneled with computer terminals.

She removed the dish's lid and motioned for him to inspect the firm-soft agar. "Our new agar is composed of Shuffle-It Modifying Molecules, sensitive to electromagnetic signals given to them by a computerized field." She turned to the equipment-packed computer bench. "Say we wanted a Fructose-Glucose-Sucrose medium." Her gnarled fingers tapped a nearby keyboard. "Just insert as many agar plates as necessary—" the little dish was shoved into a slot, "—and out will come perfect, sterile, 100% useable FGS media, of any preselected consistency."

She handed him the ejected, slightly warm dish. There was no visible change in the cloudy agar. But removing the lid this time liberated the cotton-candy aroma of sugar.

"That's the simplest use," Professor Oates continued. "Far more applicable in current research will be the Auto Program-A-'Strate feature, wherein the scientist simply puts a purified culture—say, penicillin mold—into the computer auxiliary, which analyzes the organism's specific needs and programs the agar ingredients *specifically for penicillin.* Optimum conditions, no possibility of contamination, you can grow enough mold to paper the walls. Surely you can see the possibilities in monoclonal antibody work. And *beyond* that—" She watched Perkins wait, amazed, for her next words. *Hooked him already!* "At a mere pass with a Biotek Agar-Away signal-wand, the agar itself—" her spidery hand found a flashlight-shaped instrument, pointed it, "—*sublimes!*" There was a little *poof*, and before he could drop it on the bench, the little dish in the inspector's hand was crystal-clean empty. "Thereby," Professor Oates concluded, "leaving the cultured material itself isolated, totally unharmed, uncontaminated, and ready for use or study. The media vapors are safely collected in the wand, which comes with a handy assortment of feed-lines and optional recycling containers."

Perkins blinked after a short hesitation. He reopened his briefcase and shuffled his papers, popping away a paper clip. "Project Two," he read, "*Refinement Of Computerized Bioassay Technique*. Part of the agar thing?"

"Correct. The groundwork is complete; all that's necessary are the field trials, for which we require funds for extra staff, equipment, and, later on, payment for confirmation testing by independent labs. Now back in the main lab—"

She led him to a cart tucked away between a blue-and-red-labeled plastic human skeleton and a large wall chart featuring full-color illustrations of intestines. "By the way, I'd like to point out our sterile hood here. Air flow of eight cubic feet per second, entering through our own version of the Edwards Vi-Kleen micropore filter. We feel so confident about our hood that we're currently using it in our own labs, and the Midwest Epidemiology Facility has agreed to test it in their Hanta Unit. That's the program you awarded five million in '96."

"And this?" He indicated the cart's battery of gracefully rocking test tubes half-filled with what appeared to be dilute onion soup, corked by fluffy cotton balls.

"Gene glue," Oates proclaimed. She glanced only briefly at the tipping tubes. "I can't watch them too long. That back-and-forth motion makes me queasy."

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"Gene glue?" The inspector's suspicious gaze peered at the rack of tipping tubes.

"Project Three." She tapped his wad of papers. "A distant spin-off of the programmable agar, Mr. Perkins. Consists basically—this is very simplified—of special molecules that are constructed to 'recognize' and 'amputate' little chunks of DNA. The chunks are then glued to harmless bacteria. These test cultures here, for example, contain bacteria factories that are busy making one of the human bile pigments. A simple compound, but about as complex as human insulin, with which Forbes, Ehrstwyl, and several other people, who, ah, you fund, are working. Now Forbes has to go through a horrendous trial-and-error process before he can insert the human insulin gene into bacteria, then culture-and-wait to get them producing insulin, *then* go through another lengthy process to collect their insulin—well, you get the picture. Now wouldn't Forbes love to have a substance that would glue itself exactly to the insulin gene in a clone of human cells? Then *zip!* he'd collect the gene with a Biotek E-Z Separator, a quick transfer reglues it to bacteria DNA, and before he can say 'juvenile onset' he's producing *gallons* of pure human insulin, ready for market." She waved elegantly to the rocking tubes. "We glued the bile pigment gene on these guys yesterday."

Perkins curled a lip. "These tubes darker brown than a minute ago?"

Professor Oates was warming to her lecture. Ignoring Perkins' comment, she took a deep breath and let fly again. "Gene-markers—Project Four—are a direct offshoot from this work. Inserting identifying markers into the chromosomes of standard laboratory animals will greatly ease the problem of lab mix-ups. Let me give you an example. One very expensive strain of mouse is used in immunobiology research because it has been bred to have a poor, almost nonexistent immune system. Needless to say, these mice are invaluable in AIDS research, cancer studies, autoimmune diseases like arthritis—all your highly-funded 'biggies,' Mr. Perkins. But all white, pink-eyed lab mice look alike! What if the biological supply company sends the research facility the wrong mice? Or if the mouse cages get mixed up?"

Perkins nodded, expressionless. (Gabrielle Oates knew exactly what had just popped into his mind: that *he* had been the one to OK that multi-million-dollar graft-rejection study at Whitewater Tech. Dead-end results and inexplicable failure of experiments for thirteen months—until a janitor was discovered rehousing 'poor little hungry mousies' of any escaped strain into the experiment's *carefully* isolated mouse cages.)

"If," Professor Oates continued, "a Biotek gene-marker is cultivated for, say, a special iris pigment, there you have it. Your special mice now have, say, *purple* eyes. All of them, without generations of selective breeding. And because the marker stays with the DNA, all *baby* special mice will inherit purple eyes, too! Until Biotek Had-A-Gene is administered to dissolve it."

"Reminds me," said Perkins. "Will have to take a look at your animal facilities. NSF grant recipients are subject to various animal-abuse regulations. Can't get involved with those brain-banged monkey kinds of things. Political correctness and all that."

Professor Oates smiled sympathetically. "Yes, well, that will be no problem. Biotek does not maintain animal colonies." Still smiling, she paused a moment to scratch the back of her neck.

She then led her guest to one of three workrooms in a cul-de-sac near receiving and shipping docks. She indicated a breadbox-sized metal container on a corner of a clerk's desk. "We hire independent labs to do our animal experimentation," she explained. "This was just sent over from State Tech's Agricultural Pest Lab—you're funding them—to show us how our latest consignment with them

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is doing." She lifted the box's screened cover and dug into the interior with a forceps, eventually extracting a wiggling gray maggot. "This is a distant relative to the waxworm commonly used for ice-fishing bait."

Perkins eyed the forceps' captive sourly. "Waxworm," he mumbled. "Larva of a honey bee parasite, I recall."

"*This* larva," Oates said, her cracky voice squeaking a bit with emphasis, "is a much more virulent honey bee destroyer. When it infects a hive, it specifically attacks the cells of bee grubs being fed royal jelly; that is, those that would become queens. When the hive's adult queen dies, that's it. The workers can't bring another queen to maturity. No more eggs are laid, so when the honeybee workers die of old age—no hive. Can you see the implications here with California's killer-bee problems?"

He could.

"We're working here with Anderson and his crew. You're—"

"I know, we're funding them," Perkins sighed.

"Then you know that they're currently breeding this hive parasite to be a very specific invader of *only* the hives of ***killer*** bees. But this is very tricky research," she cautioned. "We don't want mass releases of a bug that might also attack and eat the grubs of our *tame* bees, so Anderson has bred a parasite that *can't* live in ordinary bee hives. They require wax from killer bees only. But we all know it's forbidden to raise killer bees in the lab. So how can Anderson rear his parasites?" She redeposited her captured grub in its box. "Look!"

Perkins looked. The knotty finger pointed to an almost-buried gray ball of fat maggots happily eating the straw-colored onion-peel-ly fluff in which they lived.

"Our new Wax-Alive Maggot Chow & Bedding here will soon be the mainstay of every waxworm research facility in the country!"

* * *

A half-hour later, Professor Oates leaned back comfortably in her padded office chair and watched Perkins accept another cup of Johnny's fresh-brewed coffee. She sensed that victory was secure. Biotek Institute's no-nonsense organization and just-plain-hard-work had appealed to the inspector's bureaucratic sensibilities. Moreover, the grand excitement of scientific research treading the edge of breakthrough had penetrated even to Perkins' skeptical heart. He sipped his coffee between reassortment of notes and papers, arranging things carefully in his briefcase. Gabrielle knew that this time he would not, as he usually did, toss them directly in the wastebasket as soon as he returned to his own office.

A slight nod of his head and a flash of his eye answered her polite inquiry. OK, sister, you got your grant funds. "But one question, Professor Oates. You've indicated all the practical applications of Biotek's projects. Why don't you go ahead with insulin-making and killer bee eradication and all that, *yourselves?*"

Gabrielle Oates folded her hands on her doodle-filled blotter and leaned over the desk. "Agar, biochemicals, animal supplies—we make the *tools*, Mr. Perkins. Our contribution is to provide the best possible incentives for the researchers who are *our* inspiration." She paused to grin broadly. "We like to think we're the ones who keep modern science in *business*."

After Perkins had left, the itching on the back of her neck reminded Professor Oates of her interrupted earlier work. Rubbing the tender sting-welt, she exited her office and headed down the corridor, passing the main desk again. "Grant's in the bag, Johnny," she said to the receptionist. "And great coffee; thanks."

"We knew you'd do it, Professor. And thank *you*. Are you going back to the TCoB facilities now?"

"Yes, I'll probably be over there for another hour or so. Flash the light again if we get more company."

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"You bet."

Before checking the Bee Room, Professor Oates decided to look over the Infectious Diseases lab first. She inanely read the "CAUTION—REQUIRED INOCULATIONS" notice for the thousandth time during her mandatory wait under a violet glow in the sterilization antechamber, then entered the neat little lab. Several Biotek Saf-Air hoods hummed a droning melody as they filtered the air of every escaped protovirus. She briefly glanced at the organized stack of culture dishes labeled "HIV VIRUS: AIDS TYPE A-AFRICA", other stacks announcing types "A-H1-SAN FRANCISCO", "A-H2-STLOUIS", and so on, through "AIDS TYPE A-H12-CASUALCONTACT", which carried a hand-written second label "*Release Pending Board OK.*" All seemed in proper order. She nodded to herself; that new technician was working out just fine. Nice friendly postdoc from MIT. Too bad his degree in bioengineering was so common these days. He'd practically have to inherit any job paying more than minimum wage. Professor Oates clucked her tongue. She hated to see such bright young minds going to waste. *Well, we try to create as much demand as we can.*

She opened the freezer to count the stock of the new virulent smallpox II that was about ready to go, checked the pressure on the reserve canister of concentrated arthritis inducer (one of her own early projects, the success of which exemplified by her aching hip), then noticed that the "DIABETES—WATER SUPPLY DISTRIBUTION ONLY" was almost out of ampules. She clucked her tongue again and shook her head. Have to see about getting that refilled, she thought. If we stopped stocking, what would poor old Forbes do with all his cultured insulin?

She hurried past the various cancer racks, winking at the one activated by minute exposures to lead. *Don't you worry,* she thought to the freeze-dried packets, *with a little modification you'll work just as well with the combustion products from those new lead-free gasolines.* But she didn't dawdle further, eager to get back to the bees.

She unshuttered a tiny observation window within the antechamber and watched the bees' activity for a few moments. Still riled up. Good; wouldn't do to have them get all wimpy on her. Gabrielle Oates liked the idea of the bees. There'd been far too much emphasis on the biochemical stuff; time for some plain old natural history again. Why, students were *shunning* degrees in basic biology—zoology, botany, the beautiful sciences of Linnaeus, Fabre and Darwin! She'd have to see what the board of directors could do about more whale beachings. Perhaps (she recalled Johnny's marvelous coffee) the time might be ripe for a really *good* coffee blight in South America. Could be mutated to hit the pineapple plantations, then sugar cane. . . . She let her mind whirl on the possibilities while admiring the bees through the little window. The bees had also noticed her. Slight motions of her head and blinking eyes had drawn several to the glass to inspect. "My good bees," she murmured lovingly, "yes what *good* bees you are, so much prettier than icky bacteria, *happy* bees, bee, bee, bee b—*YEOWICH!*"

She had forgotten to turn on the microwaves after she'd exited the antechamber this morning. Another stowaway had wormed out of some wrinkle in the protective clothing and had immediately taken aim at the back of her neck, this time on the other side.

She wildly grabbed the bee and flung it down, crushing it under her shoe, a moot act for the insect had already committed suicide by stinging her. She turned to the observation window. "You vicious little bastards, you," she snarled between her false teeth. "I think its *high* time you were discovered in New Jersey!" ◙

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ODDS AND ENDS #1

Several of my columns last year drew a heap of mail. The "three-door-puzzle" spurred far more people to write than anyone expected, and the "cry for help" column, "Calling Dr. Diogenes," did, in fact, bring in a lot of letters that were very helpful to my friend. Although this column isn't likely to bring in many letters, it will take care of some necessary housekeeping work. So don't go looking for any kind of theme.

First off, I think I'd better remind folks about letter protocol. If you address a letter to me and send it *care of Analog*, then Stan Schmidt won't see it; the letter will just be forwarded to me. If you send a letter to the editor, or just to *Analog*, it will always go to Stan first as a letter to the editor, and only if he thinks he might use it in the magazine will it then be forwarded to me. (Exceptions were made in the case of "Dr. Diogenes" of course.) If you send me a letter, I'll be honest with you right now and tell you there is no guarantee I'll reply. This is largely a matter of time and having three little kids at home. If you want to maximize your chances of getting a reply, please enclose a SASE. That still won't make it a lock, but it does help. I also seldom respond to critical letters unless I've decided that the letter writer actually has me dead to rights on something.

The letters that came in about the "three-door-puzzle" were quite a hoot. You've already seen what's been printed in *Brass Tacks*. I figured that after the critical letters saw print a raft of "Jeff-was-right-after-all" mail would follow, and I was right about that. Oddly enough, it seems that the letters I got from overseas were far more likely to agree with me than those that were homegrown. For all who wrote, thank you. If you do the Internet, pay a visit to www.analogsf.com. In the forum I listed a website put together by an *Analog* reader which is just chock full of information on the three-door-puzzle.

Lots of helpful mail arrived for my sick friend. His name is Dr. Kirk, by the way. Since writing that column, his health has improved enough for him to return to teaching. He still has periodic bouts of excruciating headaches and he is by no means out of the woods, but he has found that medical help that we were seeking and so I'd say the column was a success.

I finally met Kirk in person last November. We talked for hours, mostly about physics, and the person that I'd come to know through email turned out to be the same guy in person. I now consider him one of my good friends, and we expect to be able to do some work together in the not-too-distant future.

I'd like to thank Dr. Henry Stratmann for his input and advice about Kirk's health. After the column was written, but before it saw publication, I contacted Dr. Stratmann and we had an excellent conversation about it at Worldcon '98. Like all the other people I've met

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who are connected with *Analog*, he's a Class A kind of guy.

Finally, a great many of the helpful letters I received pointed toward the benefits of alternative medicine. Many of these letters were apologetic in tone, as if the writer didn't want me to think he or she was crazy for even suggesting such a thing. Have no fear, ye letter writers. This is the *alternate* view. Although alternative medicine and therapies are not among my main interests, even I have done a bit of investigating of colloidal silver (recommended by more writers than anything else), and the topic deserves a column some time. (Here's a hint—my colloidal silver took the odor out of a diaper pail far better than any of the industrial strength cleaners I've used.)

Oh, I must also add that I have forwarded every single piece of mail that I've received concerning Dr. Kirk's health to him, and he welcomes them all.

I said above that I almost never reply to critical mail. This is not because I don't take criticism well (I *don't* take it well, but that's not the reason I don't reply), but because so little of it is well-considered. This should not be taken as criticism of the writers' intelligence. I imagine that what usually happens is that I write something that ticks someone off, then he (they? whatever—*damn* evolving language, anyway!) dashes off a critical letter and has it in the mailbox before he's had a chance to cool down and really think through what he wrote. Of course, these days, the entire idea that what pops immediately to mind could be something other than one's best thinking on a subject is seldom emphasized in our institutions of higher, or even lower, learning.

Anyway, what a whole heap of people have got to start learning how to do is to pay attention to their unconscious assumptions.

Here's an example.

Not so long ago it was mentioned in the establishment science magazines (I seldom read them anymore—same tired thing month after month. I'm sick of cosmic "inflationario" crap and the MACHOs and WIMPs of dark matter. I suggest STUPIDs for STrictly Unfindable, Purely Imaginary Devices, cooked up in a desperate attempt to save a failing theory.) that the Japanese cold fusion program had come to an end. It was left for the reader to conclude that the reason for this must have been that there was nothing to cold fusion to begin with. Since magazines like *Nature* refuse to publish papers which show the positive CF results, it's no surprise that *Nature* readers are unaware that there are any. But the unconscious assumption to be guarded against is that half the truth is a good guide to the whole truth.

As it turns out, the cold fusion program in Japan was a stinker almost from the beginning, and it succumbed to bad management, which is exactly what was predicted would happen by people in the cold fusion community if the Japanese didn't get their act together. That's the whole truth. Fortunately, other successful CF research still goes on in Japan.

If any of you want to find out about some of the Japanese CF efforts, there is no better place to go than to the first book published by Infinite Energy Press, Tadahiko Mizuno's *Nuclear Transmutation: The Reality of Cold Fusion*. (Any of you other explorers of extreme physics out there who can't find a more conventional publisher for your work might want to run it past the editorial board of IE Press.) Right from the beginning, Mizuno set off to investigate the claims of Pons and Fleischman, encountering success and failure along the way. Although not written for this purpose, nevertheless, *Nuclear Transmutation* will give you excellent insight into why it is you still don't have a CF coffee warmer in your home. This has nothing to do with CF not being a real heat-producing effect. It just turns out that (1) it certainly isn't

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regular fusion, and (2) it is still not well understood.

Contrary to popular propaganda, CF was not disproved in 1989 (c'mon, folks—just how the hell do you prove a negative in the first place?). As Mallove (July, '97 *Analog*) pointed out in detail with a huge number of references to back him up, some kind of "excess heat" process does exist and has been verified. Mizuno's book goes a long way toward explaining just how deucedly difficult real research is, and in particular, how fraught with puzzles cold fusion research is.

Mizuno discusses in depth the transmutation products found after many CF experiments. "Where's the ash?" (from a nuclear reaction) was one of the earliest questions. Well, it was found; tritium, helium, and unfortunately for purposes of designing a simple model, half the rest of the periodic table, too. It was also the case that the amounts of tritium and helium were way too low to account for the observed excess heat.

For me, the best part of the book is chapter 4, wherein Mizuno details the work and preparations he had to go to before he even *began* to run a serious experiment. It can take years before one knows all the relevant variables to control for in an experiment. In the case of palladium-heavy water systems, you need those years.

By the time you see this column, the book should be available from Amazon and the other usual suspects. You can also order it directly from the publisher at the IE website (www.infinite-energy.com).

Now, I have one other thing to leave you with—a physics problem, surely familiar to those of you who had engineering physics, particularly electromagnetism, in college. This problem appears routinely in physics textbooks, and it's considered fairly easy to solve. It's usually referred to as "the railgun problem."

Take two bare conducting rods, parallel, a few inches apart. These are the rails, and copper or brass rods work well. To one end of these rails, connect a power supply, one lead to each bar. This end is called the "breech." It doesn't matter if the power supply is AC or DC, but for a practical experiment, you'll need a lot of amps. Include a switch in the circuit somewhere. Now, across the rails, lay a round, bare conductor. (Note well—the problems always say "a conductor.") This piece is called the "armature" since it is the part that moves.

Throw the switch. What happens?

Well, what's supposed to happen is that the armature will move away from the breech toward the "muzzle". This follows directly from the Lorentz force law. Typically, the textbook question might ask you for the magnitude of the force on the armature given some current or whatever, but it is always expected that a conductor will move toward the muzzle. Why? Because that is the direction of the force supplied by the Lorentz force law, and that is supposed to be the only law at work here. (Word of warning to home experimenters—what happens in real life is that the armature usually spot-welds itself to the rails before it moves at all in simple experiments. If you want to try this, a bit of messing around may be necessary.)

However, if you use as your armature a piece of ordinary soft steel, the pesky thing will *head toward the breech!*

Why?

Try looking it up. If you can find an explanation in the published literature I'd like to know about it. I don't know of any. But one thing I do know is that the steel armature *will* head toward the breech entirely in contradiction to the Lorentz force law. *That* I've seen with my own eyes on my own pair of rails.

Let's see—I pushed cold fusion again, denigrated conventional cosmology, and left you readers with an example of a first-order-failure of standard college electromagnetism. I guess I'd better keep my eye on the mailbox after all.■

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Laurence M. Janifer

RUSTLE OF SPRING

Some occupations include a lot more variety than others. On the other hand, some specific assignments have a lot less variety than you might think...

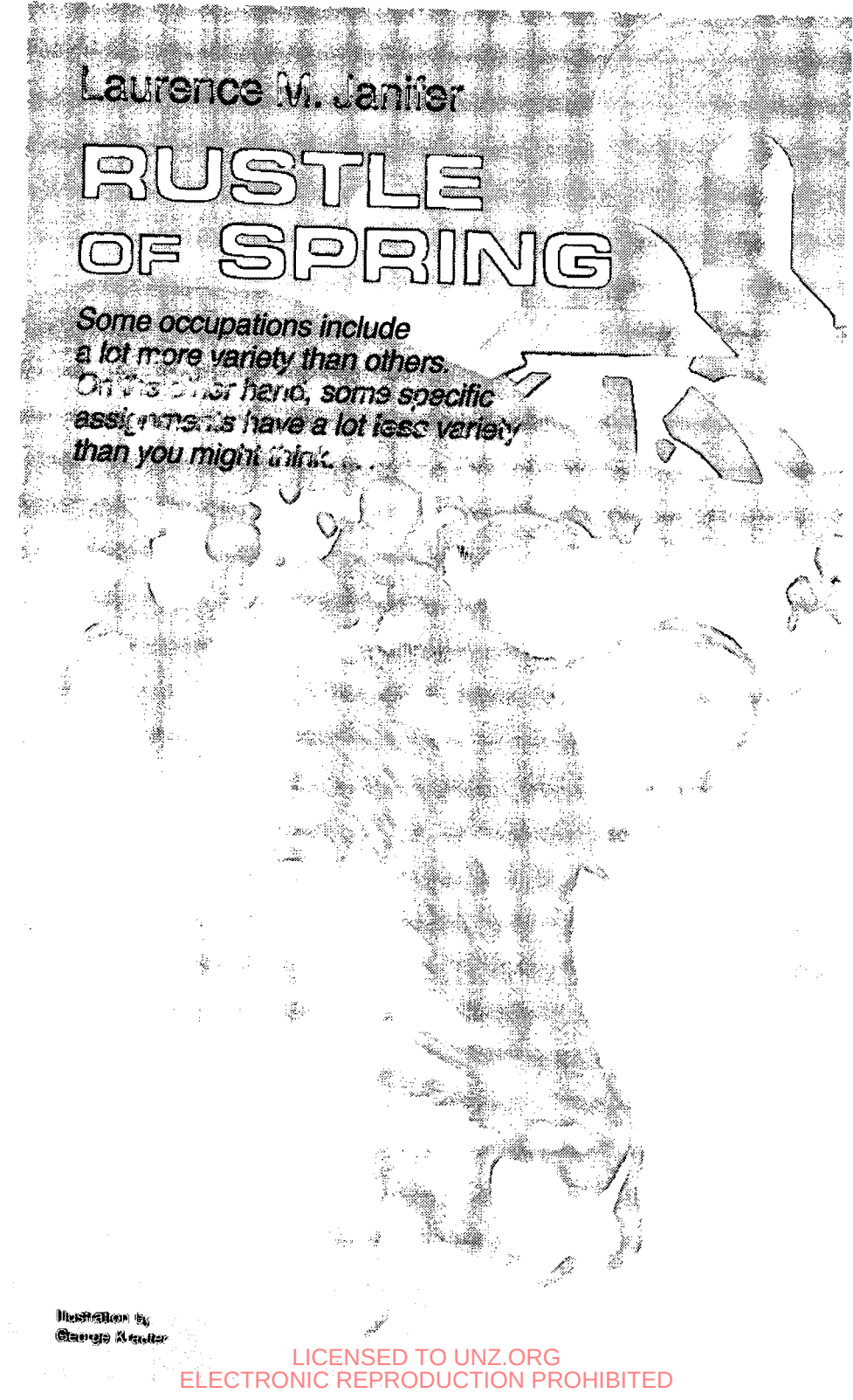

Illustration by George Kapusta

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Words are funny things. Sometimes the meaning of one is simple: my business cards read *Gerald Knave: Survivor*, and surviving is what I do for a living. Of course, it's what *everybody* does for a living—people who don't survive don't have livings—but a Survivor survives, so to speak, in the superlative: the Comity pays me a depressingly small sum now and again, and in return I go out to new planets and survive on them for a Standard Year apiece, in order to prove either that other human beings can turn the same trick, or, occasionally, that they damn well can't. I'm a Survivor: surviving is what I do. Simple.

But sometimes the universe gets in the way, and words get complicated. "Babysitting," as you'll find out in this report, may not be quite what either of us once thought it was—and "clone" has had an odd kind of history on a planet called Spring, which I rather hope you've never heard of.

People get cloned all the time, of course—or their bodies do. (We'll get to the babysitting shortly.) The Ancients, back before the Clean Slate War, talked a good deal about cloning actual whole people, and thus adding to what they thought of as the Population Problem (a Problem the Clean Slate War took care of, short-term, and planetary settlement, aided by Survivors like me, has so far taken care of on a longer time-scale), but despite a lot of dedicated work by researchers—Dr. Frankenstein and all the others—the Ancients never really did get the hang of it. They did clone Hell of a lot of microscopic life-forms, a few domestic animals, and, apparently, a more-or-less humanoid entertainer called Elvis Presto—but that was it.

These days, though, most people's bodies get cloned, if not at birth, very damn soon thereafter, and that provides the handy source of spare parts we use when, due to accident or malicious mischief, one of us needs some.

Except on Spring. On Spring human bodies don't get cloned, they get duplicated—and the difference (which is only a difference in wording; the process is unchanged) is important. If you mention casually that your Aunt Sadie got a new left foot from her clone, people will gasp, and they will avoid you. What she got her new left foot from was her duplicate. Clones are—well, that's why I went to Spring in the first place.

Clones are animals, and specifically food animals. On Spring, there are three or four chickens, five or six sheep, an equal number of cows, more or less—and so on—cloned over and over again to feed what is, for a Frontier world, a fairly large population. It's like the miracle of the loaves and fishes—without the miracle, unless you insist that the whole technique of cloning is one.

This report doesn't start on Spring, though: it starts on Kingsley, which is a much more glittering kind of place, and full of fun for the casual traveler. Stuck in the middle of the fun, like prizes inside a Christmas cracker, are a small sprinkling of gambling dens, and I happened to be inhabiting one of them—Tozer's Hall of Winners, if it matters—when Franzick Donner tapped me on the shoulder.

It was a sizable tap: Franzick is about six and a half feet high, and about four feet wide. I once knew an actor who said, of people who dressed badly, that they'd been outfitted by Omar the Tentmaker; in Franzick's case, Omar could have provided a perfect, form-fitting jumper right off the rack. The one he was wearing that evening was gold, with royal-blue stripes, and only the shade cast by his hat enabled me to see him without eye damage.

The hat was what the Ancients called a ten-gallon size. Back then, it was worn by a kind of person, hailing from (according to legend) Texas, whose career was being a Millionaire—that is, such a person owned a million of something, usually cattle or oil-wells. In order to

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show his status to other Texicans, he carried a hat which was filled with ten gallons of (depending on his specialty) oil, or milk.

Franzick's hat was empty, except that his head was in it, but it was clearly a ten-gallon affair, immense and broad-brimmed. When he'd tapped me, I'd waited long enough to see the little ball bounce solidly into Red 19 instead of Black 20. Then I sighed, turned and said hello.

Franzick said: "Howdy, stranger," as he usually did, and asked me how I was doing. I shrugged.

"Win some, lose some," I said. "Just now, I'm waiting for the win-some part to come along."

He nodded gravely. "How," he said, "would you like to make fifty thousand dollars?"

"At my current salary level," I said, "I should be able to put that much aside in thirty or forty years. Of course, I don't entirely depend on my current salary level—"

"Don't I know that, friend?" Franzick said. "Haven't I heard stories about you? There was one about some gold shipments—"

"A canard," I said, "and a particularly base one too. I help out a friend occasionally—just now and then—when asked—"

He gave me a flat, sudden stare. "I'm asking, Knave," he said. "It gravels me to do it—it does. On Spring, we mostly curry our own horses. But this thing's got me beat. And I can't afford to go away to take care of it; I've got to care for my spread."

I nodded. "You came to Kingsley to gamble and forget your troubles?" I said. "And now you have to—"

"I came to Kingsley," he said, "because I thought the person I needed was here. You may have heard of Roubor Transit."

I took a deep breath. Around us the merry buzz of gamblers losing money went shamelessly on—which seemed wrong, somehow. The mention of that name, damn it, ought to make for a brief, hushed silence anywhere, at any time—if not a brief, hushed attack of nausea.

I tried for a smile. "Roubor Transit has a specialty," I said.

"I know that, damn it," Franzick said. "He gets results."

I spoke very carefully. "I wouldn't trust those results very far," I said. "Transit abducts people—all right, it's never been proven, but proof is something for the lawyers, and what else is the damn monster famous for?—and takes them apart. Slowly, over days. He enjoys it. During this process—it's called torture—he sometimes asks them questions, or gives them instructions."

"I know all that, Knave," Franzick said. "But—"

"I'm not sure he gets trustworthy answers to the questions, just to start with," I said. "When you're hanging by your thumbs, while Transit is removing your skin strip by strip, and an acid bath is eating your toes away, I'd venture to say you'd tell him anything he wanted you to tell him, true or not. Possible or not."

"Damn it," Franzick said, "what other choice do I have? I don't need answers, I need action. And he can make it happen for me, Knave. But Transit's not here, he's on Debrett. I can go and talk to him there, I can persuade him to take care of things for me—"

"I would not," I said flatly, "advise it."

"—but I can't just forget my spread any longer. I need somebody to take care of the spread while I'm gone. And it has to be somebody with no ties to Daniel Dorton. Somebody who doesn't even *live* on Spring. An absolutely trustworthy somebody. And that means you, Knave."

I nodded. Carefully. "I've never so much as heard of Daniel Dorton," I said. "And I've been trustworthy, now and then. But before you go off hunting Roubor Transit, for God's sake—"

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"Dorton's done me dirty," Franzick said. "I'll have it out of his hide, one way or another. If it has to be Transit's way, then it has to be. But while I'm finding him—"

I sighed. "Maybe," I said, "I can help."

"You can see to the spread for me, Knave," he told me urgently. "You can do that. If you find a way to get to Dorton before I get back, fine. If you don't—the spread'll be safe, and I'll have Transit with me. I don't like him, God knows, and I sure don't like his methods—but I've got no choice, Knave. No choice at all."

I sighed again. Transit had found a way to make his hobby—torturing people—pay off for him. He was known, in a very quiet way, on sixteen planets, and—because there are always people who want results, and aren't too careful about how they come by them—he never lacked for custom.

My hobby, on the other hand, wasn't paying off at all well. And maybe, after all, I could actually do something helpful—something that would make Roubor Transit unnecessary. Just maybe . . . if Franzick filled me in . . .

"You mentioned fifty thousand dollars," I said. Which is where the babysitting began to come in.

Spring is a rural sort of planet—with high-tech accompaniment. It has ranches and farms and stations, it has country fairs and barn-raisings, it has grass and trees and rolling hills. Then you take a second look.

The country fairs involve computer-chess contests and genome-map judging. The barn-raisings are mostly done by teams of Robbies under mech direction from state-of-the-art Totums. The grass is eighteen varieties of the best-bred members of the graminae family from six planets including the old Original, and the trees are guaranteed disease-free (nobody's trying for "pest-free" because the pests turn out to have useful jobs in the ecosystem). The ranches and farms and stations are satellites of the thriving biotech industry.

Well, there's no place like home, as Dorothy Lamour told her red slippers, but home has a way of changing on you, if you give it a few centuries' worth of research—especially research into cloning, which is what the whole damn planet, more or less, runs on.

There are immense companies on Spring that each own (for instance) exactly one cow. The cow—let's call her Clarabelle—is cloned, and cloned again, and then cloned as many more times as anybody has time and materials for. (People, meanwhile, are getting duplicated. It doesn't do, Springfolk feel, to use the same word for the same technique as practiced on animal bodies and on human ones.) The company—Clarabelle, Ltd.—licenses farms and ranches, providing each one with a large herd of identical Clarabelles, and the farms and ranches (for some damn reason—words are funny things—they're called stations only if Clarabelle the Cow is Sheila the Sheep) sell the resulting meat and milk, paying a royalty to Clarabelle, Ltd. and living, if possible, on what remains.

If there were only one original Clarabelle (or only one Sheila the Sheep, or Charlene the Chicken, or whatever), Spring would be groaning under a Cow Monopoly, whose owners could hike up the price of meat and milk (and Sheila Cutlets, and Charlene Eggs) pretty much at will. But there are laws against monopolies on Spring, as there are on most worlds—and, what's much more important, there are traditions against monopolies too. People who (like Roubor Transit, for an especially ugly instance) will break a law almost at random will balk at breaking a nice strong tradition; and the result, on Spring, is a thriving competitive economy consisting of several Cow Companies, and as many Sheep and Chicken and (for all I know) Goat and Kangaroo and Emu Companies—not to mention Horse Companies (which provide riding animals) and so on.

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Franzick owned a ranch (the F Word) that boarded three hundred head of Clarabelles. So did his nearest neighbor, Dorton Daniel—and while that fact had once been convenient, it had very recently turned into the source of his problem.

"We know all about our herds," he'd told me. "We know what weaknesses the animal has, what feed mixtures are best for it, what its cycles are like—daily, yearly, every damn thing. A clone is a very convenient sort of thing, Knave: bar an accident now and again, there's very little unexpected that can happen around the ranch. The cows have been studied for six generations now, and we *know* them—because every cow is physically—genetically—identical to every other cow on the place."

"And you know what milk production is going to be, or meat production," I said.

"Within fairly narrow limits, sure-Henry we do," he said. "Takes most of the damn guesswork out of this ranching business, Knave—takes the guesswork out of buying goods, too. You buy a Clarabelle quart or a Clarabelle steak, you *know* what you're getting—exactly."

I thought about it for a minute. The whole idea was beautifully simple, and I could see it taking hold all over the Comity—a Clarabelle, a Sheila, a Charlene for every planet. Simple, efficient, predictable.

And what happens to those of us who enjoy (as they say) the higher amenities? What happens to gourmet shopping, and eventually to gourmet dining?

Which is why I hope you've never heard of the planet. It's hard enough getting a decent meal together now; if the universe fills up with Clarabelles there'll be nothing left but nutrition.

Well, whatever the promise or threat of that notion, it couldn't be what Franzick needed to unravel. "It sounds like a nice, peaceful kind of life you've got," I said. "When did it stop being nice and peaceful?"

He scowled at me. He's got a very impressive scowl, almost a foot wide. "One of my Clarabelles has been stolen," he said, "and I have to get her back."

He made it clear, very quickly, that what he needed to get back was one particular, individual Clarabelle. Myself, I wasn't at all sure there *was* such a thing as an individual Clarabelle—the damn animals were identical clones, weren't they? Nor could I see, at first glance or at fiftieth, why any handy Clarabelle clone of the same generation wouldn't do. "What's special about this one?" I said after a bit.

"Cloning," Franzick said, "means that every Clarabelle is physically, genetically the same. But they have different lives, Knave."

Light began to dawn, but not very much. "One of them trips over a clump of flowering something-or-other, and develops a mental block against flowering something-or-others. And this trauma affects the milk, or the meat, or something?"

"For God's sake, no," he said. "Clarabelles can be *trained*. Almost any animal can be trained, if you've got the patience for it. Cows are quiet animals mostly, and not impressively speedy on the uptake, but they're not *stupid*. They're not chickens; they have brains."

I nodded. "So you have a trained Clarabelle," I said. "She jumps through hoops? Over moons?"

"She responds to fifty-three different commands," he said. "There are *dogs*, for God's sake, who don't do that well."

"I know," I said sadly. "I've met some of them, and the command Stop chewing on my trouser-leg is always out of stock. But—pardon me for asking—what do you use a trained Clarabelle *for?* I mean, a Clarabelle gives milk, or a Clarabelle provides steaks; where do fifty-three different commands come in?"

Franzick sighed. "Knave," he said. "Dorton Daniel owns a herd of Clara-

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belles. He sells steaks, and he sells milk. I sell a third more than he does. Some years I do better than that. Now, why do people buy from me, instead of buying from Dorton Daniel?"

I shrugged. "Because you're a kindly, lovable, deserving fellow," I said, "and Dorton Daniel is a sneak and a bully. Or because *you're* a bully, which your size and heft would make an easy profession for you, and you bully people into—"

"Publicity," he said. "An F Word Clarabelle is better. Has a better image. She appears at fairs. She's on 3V shows. She does tricks—she can add numbers, for instance."

"She can?"

"Well, no," Franzick said. "Actually, she can't. But there's a cueing system—very smooth and very small—and if you ask her how much is four and three, and I cue her or my handler cues her, she stamps her hoof seven times. Goes over very big with some crowds. She does her trick in a 3V studio, or she even does it on a stand at a country fair." He grinned at me. "She's good at country fairs. Knave. She's great. Hawkers and hecklers everywhere, horns and beepers all sounding off, and she does her trick easy as you please. How much is four and three, and she—"

"Stamps her hoof," I said. "I know.

"Seven times," he said. "Right you are. She has a lot of tricks." He grinned at me. "People *know* about F Word Clarabelles. Most ranches have some sort of gimmick—publicity, image, that kind of thing—but a highly trained Clarabelle is a rarity, and this one's irreplaceable. I have to get her back."

"And you think—"

"Dorton Daniel has her," he said. "There's nothing else *to* think. He's got her stacked right in with his own herd."

I nodded. "So you wander over to his ranch," I said, "and you ask his cows how much is four and three, and you watch to see which one of them stamps—"

"For God's sake," Franzick said, "the man's got three hundred Clarabelles. If you walked them all past a given point—"

"It would take forever," I said, "because Daniel isn't going to let you do it. All right, you have a problem."

"And how will I get onto his land anyhow?" he said. "He won't let me—trespass, he says, just to look for my Clarabelle—and there's no way to sneak on."

"A problem," I said.

"But if Roubor Transit gets a hold of Daniel for a little while," Franzick said dreamily, "Daniel will beg me to come look at his herd. *Beg* me. He'll give me my Clarabelle back—he'll give me anything I want."

"Well," I said, "yes. Probably. If Transit stops while Daniel is still breathing. But—"

"I can't get the law on him without proof," he said. "And I can't get proof without setting foot on his land. But Roubor Transit—"

"Maybe," I said, "there's another answer."

He paid me in advance. "If I can't trust you, Knave, I can't trust you," he said. I pocketed the cash and was settled into the F Word ranch house, on Spring, a couple of days before Franzick was due to land on Debrett and start hunting for Roubor Transit—who wouldn't be hard to find, damn it. It was a lovely, sprawling place, sitting about fifty feet from the border between his land and Dorton Daniel's because of a peculiarity of the terrain: cattle like gently rolling landscape, but ranch houses don't, and that was the handiest flat ground. His barns were nearby, and Daniel's barns and ranch house were a few feet the other side of the (invisible, but very potent) dividing line. Grass rolled off in every damn direction, and Clarabelles wandered casually, not too far from the barns at this season.

Franzick had persuaded me, while detailing the operation of the spread, that Dorton Daniel really did have the valu-

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able Clarabelle; so all I had to do was (a) figure out how to get onto Daniel's land (his ranch was called, of course, the DD Cup) despite a lovely array, I was assured, of DD Cup watchguards and safeties, and (b) figure out, once I was there, how to identify a single animal in a herd of three hundred or so identical clones.

I had to do this damn fast, before Franzick came back with his hired torturer in tow, and I had to do it while running the damn ranch. That, thank God, turned out to be the easy part: the ranch pretty well ran itself.

I don't mean that there was no work attached to ranching on Spring, or even that all the work could be handled by Robbies and Totums. People had the Hell of a lot to do—but there were people to do that Hell-of-a-lot, and report back to me. Basic decisions waited for Franzick's return, but over a few days there weren't any basic decisions. If there'd been a sudden attack of Weather (as distinct from weather), or a mysterious wasting disease attacking Clarabelles or graminae—but there wasn't. Ranch life just went on being ranch life.

And I just went on trying to get over onto the DD Cup land.

I thought of disguising myself as a cow. I really did, for all of fifteen seconds. But that was late at night, with too much coffee inside me and a feeling of desperation rising like a mist before my eyes. I sat in Franzick's kitchen, emptied the last cup of his Keyserlingck (a fine coffee, originally from Queensland of all places, and the toughest gourmet delicacy to spell I know of) and practiced mooing.

For, as I say, all of fifteen seconds. Then I gave up and went to bed. I seldom report my dreams, because when I do remember the things they're too silly ever to repeat—but that night a Clarabelle appeared to me in a dream, and we talked things over for a while, she and I, and when I woke up I had . . . no, not the answer. But something almost as helpful: a full list of what *wouldn't* work.

Item: brands. You may have thought of this one yourself, if you're familiar with Texican lore: Millionaires used to brand their cattle (and, I suppose, their oil-wells somehow or other) with their initials, or the initials of their ranch, or whatever. Franzick's herd would all be branded F Word (or possibly just F, what the Hell): this would be burned into a Clarabelle's skin in some easily readable spot, and provide an instant ID.

On Spring, though, there's no branding. Counterfeiting is too easy—that F becomes a P or an E or an H (with a little work) or a whole lot of other things, with virtually no trouble to anyone but the animal. Instead—it's a high-tech world—some ranchers bury radio signals surgically under the skin of each Clarabelle, coded for the individual ranch. Radio signal devices can be counterfeited, too—anything can, given enough time and work—but not nearly so easily.

But there was talk, on Spring, that the radio pulses did something or other harmful to the meat and/or milk. This did not seem to be the case, according to such research as had been done—but (as Franzick kept telling me) it's all a question of image; people were a little nervous on the subject. So Franzick's herd wasn't IDed in any such way, and neither was Daniel's. The damn cattle weren't IDed at all.

Item: screening out the watchguards and the safeties, and sneaking onto the ranch by dead of night. Maybe, just maybe, I could cobble up something that would get me past Daniel's arrays of screens and fields (the fields passed nothing more solid than light, heat and air, except for stuff the size and heft of small seeds or insects)—given a week or two to work at the job, and a lot of equipment to work with. But I wasn't going to have the time; this one had to be done quick-and-dirty.

And dead of night wasn't going to

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work anyhow, because the Clarabelles would all be asleep, either out on the range somewhere (cows sleep standing up, because levering a cow from vertical to horizontal and back again is too much work for every day), or—it was coming on late Fall locally—in their comfy stalls. Waking three hundred cows and asking each one how much was four and three sounded like the plot for a very strenuous comedy routine.

Item: disguising myself as a Clarabelle Inspector, and . . .

Well, Daniel would know the local inspection teams, and he wasn't the kind of nice, trusting fellow who could be fooled by a Sudden Substitution. No.

Item . . . well, you get the idea.

I had a nice list of impossibles—things that wouldn't work at all. And Sherlock Holmes said it, long ago: When you toss out all the impossibles, the stuff you're left with is the stuff that works.

Given time, I might have come up with something smoother and simpler. But, as I say, I was rushed—so I set fire to the ranch house.

I did this at five-thirty A.M., local time (Spring has a twenty-five-hour day, less about eighteen minutes, which is close enough to Standard for the livestock to have adjusted)—"a couple of deals before dawn," as the old song says. I'd stayed up all night, quietly, which is preferable to waking up at three or four in the morning—almost anything is, including some forms of death—and I made sure to set a fire that looked as dangerous as all Hell.

Then I started the hooraw.

I hadn't shared my plan with anybody, so the ranch hands and supervisors and what-all came nicely awake and alive when I started yelling about fire and catastrophe, and added in quite a lot of yelling on their own, not to mention catastrophe. There may have been a master plan somewhere, covering fire as well as other eventualities, but if there was everybody had forgotten where it was filed. The ranch house was filled with breakables of sixty varieties, and people kept banging into them, as well as each other. The place was almost instantly littered with bits and shards of dishes, small chairs, various Clarabelle Awards and the like, as well as twitching bodies.

I'd set the fire at the end of the ranch house, of course, nearest to Daniel's land, and it was both spectacular and as little damaging as I could manage. Franzick was going to have to foot the bill for some minor rebuilding and replacing, but, if my notion worked, he wouldn't object at all. If it didn't, of course, we'd discuss things. I didn't look forward to such a discussion, even if (by good luck) it didn't involve Roubor Transit; but what the Hell, it was a good notion, I hoped.

People were rushing off toward the merry blaze with buckets of water, and some bright soul had had the sense to call in the blaze: the local fire department arrived within about six minutes. Until you have been in the middle of a true hooraw, you have no idea how long six minutes can be, or how much in the way of small damge can be stuffed into it.

It was the local fire department I'd been counting on. Like the rest of the planet, it was very high-tech—and it took up a lot of space.

The ranch folk were trying to put out the blaze with water—which isn't bad. But the fire folk had better notions, and much higher-tech. You might call them antioxidants. These are a variety of gases and suspensions that either remove the oxygen from the air or in some other handy way revent the fire from using it. Without oxygen, a fire does what humans deprived of the stuff do, ancd with even more gasping and moaning.

The good thing about these anti-oxidants, from my point of view just then, was that they took up a lot of space. The crew had arrived by air, but you don't fight a ranch blaze from the air if you can help it: the ground has too many things on it that might get damaged,

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from people to Clarabelles to ranch houses and barns. They had to land, and they needed clear space to land in, and they found it without delay. Then they needed clear space to run hoses and spits and other delivery systems, and to scurry around fitting the things up to the massive tanks of antioxidant the helis had flown in. (The stuff was stored under pressure, of course—but there's a limit to how much you want to pressurize something that's going to be shooting out of a hose into the neighborhood. This means that the tanks holding the gases were, as I'd figured, pretty damn large.)

Clearing space meant clearing away people, and within seconds the vicinity was full of running ranch hands heading away from the immediate fire scene. All of them were heading back toward the majority bloc of sprawling ranch house that *wasn't* on fire, but there was, of course, a lot of confusion in the first glimmer of dawn out there, with ranch hands banging into ranch hands, people tripping over clumps of this and that, and so on.

Nobody, I hoped, noticed one fellow heading *away* from the ranch house, toward the invisible dividing line between Franzick's land and Daniel's.

I got across without being fried, without setting off an alarm and without, I hope, being noticed at all. The first two were guaranteed—the various defenses had been turned off in order to give the fire department the room it needed.

And from there on, evertything was simple. Farcical, but simple.

I said something, a while ago, about waking up three hundred Clarabelles to ask them what was four and three. I didn't have to do that; cattle get up early, and Daniel's herd was already busy. The damn barns were full of gently mooing cattle, bustling Robbies doing their work, and a general air of hay, manure, milk, and a subliminal suspicion of odorless methane. Milking was done mechanically, and there must have been a human supervisor somewhere in case of glitches, but I never saw him—or her—and no wonder. If I had to supervise an operation before six in the morning every day, I'd do what this supervisor undoubtedly did—remote it and supervise it from a nice warm bed somewhere.

And I didn't, of course, have to ask a single Clarabelle a single question. I flew up and down the aisles, or whatever they are, of the barns like a shot, but a careful shot—just slowly enough so I could give the cue Franzick had told me about, and watch for a response.

His trained wonder of a Clarabelle, I'd been told, could do her act under conditions of absolute chaos—country fairs or 3V studios—and reacted, naturally, not to the question but to the cue. All around me cattle were shifting from foot to foot, mooing and chewing what I suppose was cud and doing whatever passes, in cattle, for thinking; all round me the Robbies were busy with mechanisms and milk pails.

The Robbies paid no more attention to me than if I'd been a bit of hay floating in the air. Not programmed for it, of course, and why should they have been? If I made any trouble, they'd red-light, the remote would squawk, and the supervisor would come and snaffle me.

I didn't make any trouble. And in the second big barn, about twelve Clarabelles in, I saw one stamp her hoof seven times.

I stopped dead and cued her again.

Bingo.

At that point the rest of my plan went into operation. I reached into a pocket, found my comm link, and pushed a stud. Outside somewhere, the fire was coping under control, which would, I was reasonably sure, be no immense effort for the fire folk—and three ranch hands would stop watching the fascinating business of antioxidizing a convention of flames, and home in speedily on my signal.

Well, I couldn't lead Clarabelle out of

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her stall all by myself, could I? Not to mention (a) unhooking her from the milking machinery, (b) fending off hordes of irritated and suddenly defensive Robbies, and (c) trying to dispose of whatever irritated supervisory personnel were going to show up.

The ranch hands, however, were good at such tricks as (a) and (b), and by the time (c) climbed out of bed to see what the Hell was going on, it had gone right on, out of the barn and over the border into Franzick's territory.

There were, of course, complaints.

One of the ranch hands complained—he'd gotten hit by an empty milk pail being carried by a Robbie whizzing into action. His friends told him milk pails were no more than a normal hazard when you were kidnapping a Clarabelle, and suggested that, if the Robbie had got him solidly, he might have been hooked up to the milking machinery, with fascinating results.

Dorton Daniel complained, and bitterly, about the loss of one of his Clarabelles. Presented with proof—she went through nineteen of her fifty-three separate commands before he caved in—that the abducted animal was being returned to her rightful home, he slunk off muttering about trespass—which Franzick, in the circumstances, shrugged off.

Franzick complained, about the damage done to his ranch house and contents—but not urgently, and not for long; the bill was small, he said, when he considered it got him his beloved Clarabelle back. He had real tears in his eyes when he said it; as I mentioned, ranchers are funny.

And Roubor Transit complained, but only very gently, at being denied both a fee and an opportunity to practice his hobby. Transit doesn't do much complaining; he has, you understand, so many ways to handle his aggressions.

And I complained, too. Damn it, one of these days I'm going to have to go after Roubor Transit. But he didn't give me an opening, that trip—which was, and is, my own small complaint. ■

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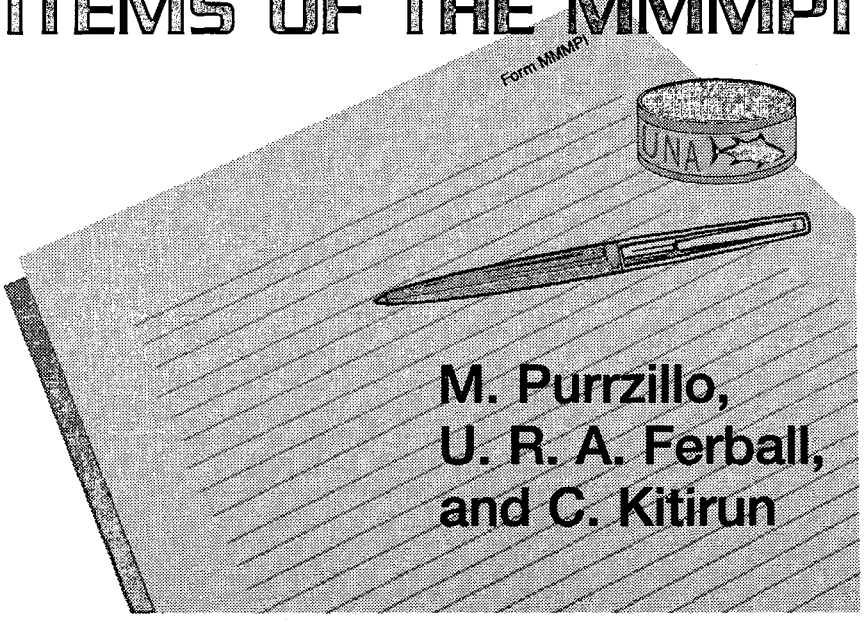
NOTES TOWARD A NEW TRAIT AS REVEALED BY CORRELATION AMONG ITEMS OF THE MMMPI



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Abstract

The Maine Mauser Multichoice Psychological Index (MMMPI) is used to categorize personality types and disorders. Based on newly found correlations, we propose a new trait, Type F Personality Cluster.

Discussion

Researchers note a puzzling correlation in selected subjects between item 401: *I am seized with terror at the thought of being immersed in water* and item 447: *I bathe several times a day* (Hunter and Pounce, 1968). The authors have discovered a third perplexing correlation, with item 68: *I find it relaxing to torture small animals.* In the present paper, a new trait is proposed, strongly correlated with these and other items in the MMMPI. After rejecting such names as *oral cleanliness fixation*, *hedonistic sadism*, and *self-induced catatonia*, the authors decided to call the trait *Type F Personality*.

The authors' clinical practices contain

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patients who appear tormented by their housemates' capricious behavior. We therefore undertook a study of 43 individuals who cohabit with our patients in therapy.

The patients typically remark that "X is driving me crazy" or "I never know what she's going to do next," but exhibit extreme distress if the possibility of severing the relationship is suggested. Clearly, the housemates contribute to a therapeutically negative climate in the homes of these patients.

The authors administered the MMMPI to these 43 housemates in an attempt to recognize traits complementary to those seen in the patients. We hypothesized a codependency between the anxiety of the patients and the obsessive cleanliness, skittishness, and narcissism described as typical of the housemates.

The researchers requested that the housemates make office appointments in order to respond to the MMMPI. However, we were told by the patients that the housemates "do not travel well," or "would scratch and claw me if I tried to get her into the car."

The researchers recognized immediately the dysfunctional relationship that had developed between these patients and their housemates. However, pragmatism suggested that the test could be taken home and administered in a domestic setting.

Some patients complained that the housemates simply lay down on the form, or attempted to tear it up, or, in one case, urinated on it. However, 7 more or less completed answer sheets were returned.

To the researchers' surprise, a clear—if very puzzling—pattern emerged at once. The subjects answered in the affirmative to the following items:

18: *I enjoy throwing up.*

96: *I often stare at spots on the carpet until my eyes cross.*

201: *Among outdoor sports, I much prefer hunting over swimming.*

258: *I sleep over eighteen hours per day.*

397: *Thunder and lightning terrify me.*

437: *I lick my body all over several times a day.*

636: *When company visits, I like to hide under the bed.*

These correlations suggest a personality configuration, the Type F Personality, that could trigger many of the neurotic traits of the patients themselves: most notably coming in to therapy sessions with clothing matted with long fibers, and a compulsion to leave the session early in order to buy King's Ransom brand tuna before the deli closes.

One of the researchers (Ferball) suggests that the relationship with the Type F housemates might actually be therapeutic to subjects who suffer from anxiety or attention deficit disorder (ADD). These patients are encouraged to sit quietly for long periods of time when the housemates settle on their laps and prevent them from moving. Kitirun suggests further that the presence of an uncritical bed mate might be a positive force. However, many of the Type F housemates are described as arising in the middle of the night and dashing around knocking over lamps. This could scarcely contribute to the tranquility of an already anxious therapeutic client.

The authors propose the development of a new instrument to measure the Type F Personality, containing the following items:

String and yarn excite me.

I find closed doors personally offensive.

Bird watching is a favorite hobby of mine.

When I am embarrassed, washing makes me feel better.

I sometimes eat bugs between meals.

I like to play with my food before killing it.

Further studies must include individual interviews with the housemates. The authors plan to undertake such a series of interviews and are applying for federal funding to supply King's Ransom brand tuna. ■

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Clotte

HOLDING THE KEY

There's more than one way to subvert a culture. . . .

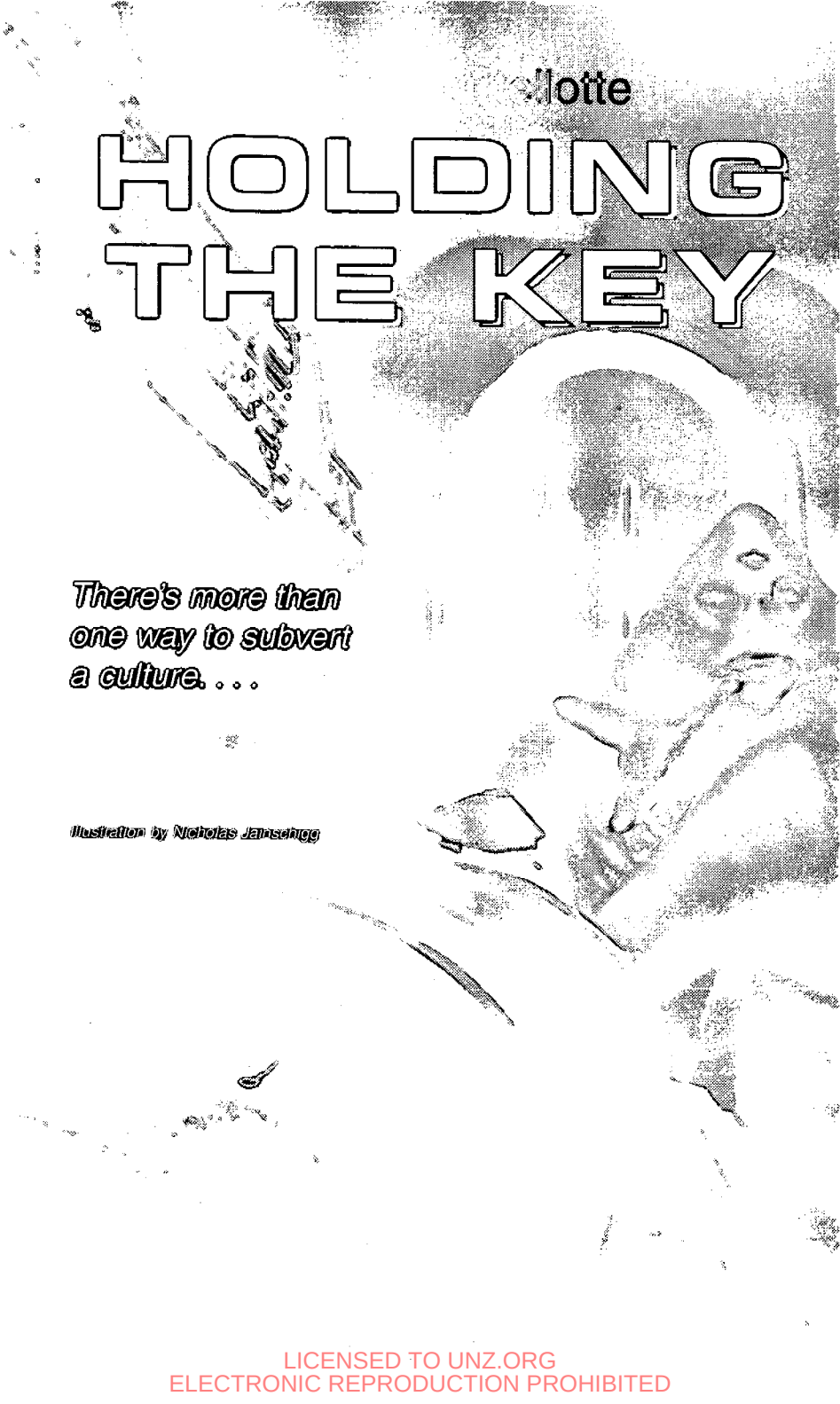

Illustration by Nicholas Jainschigg

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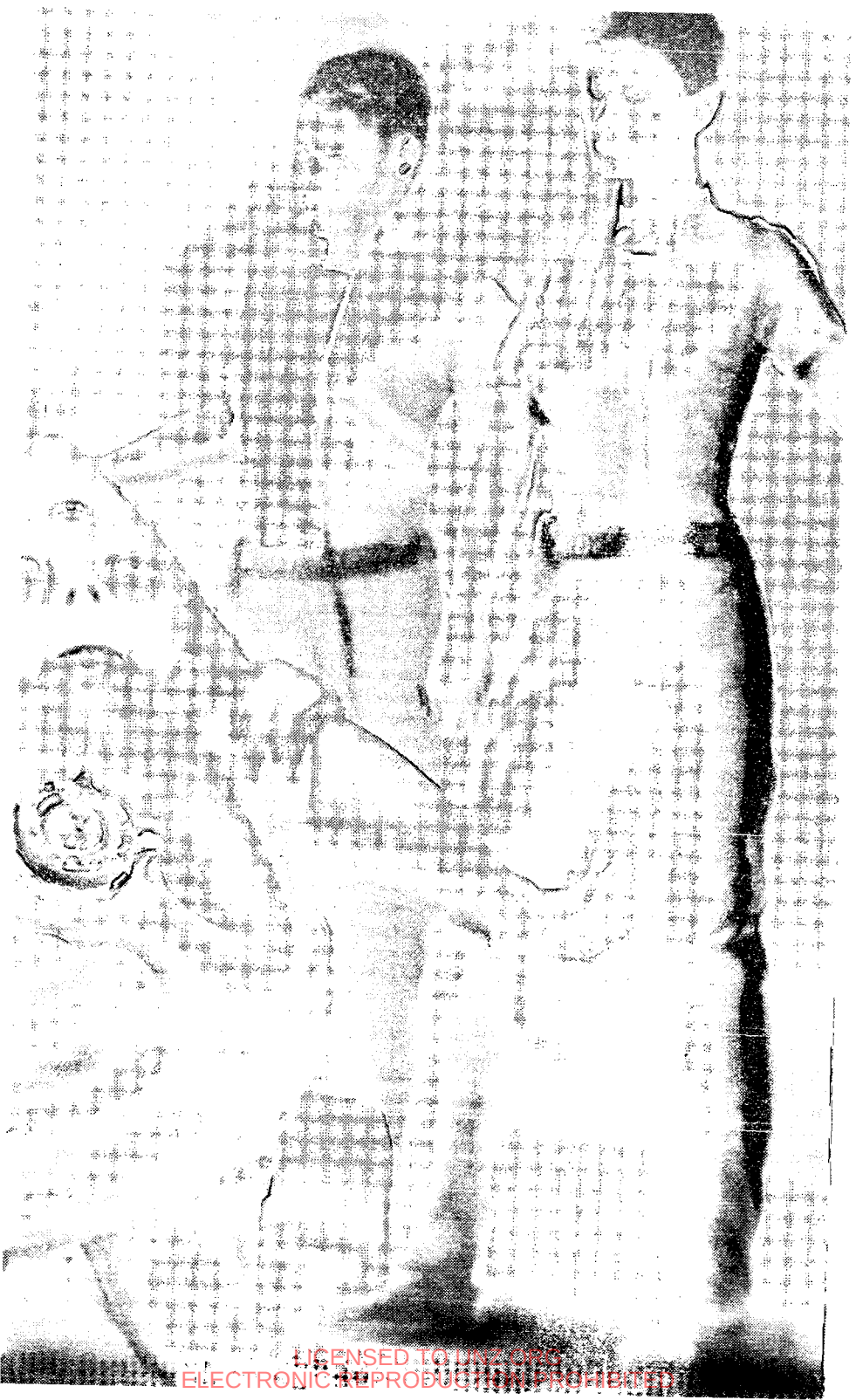

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Captain Noemi Reyes walked out of the building into bright afternoon sunshine. A breeze broke the smooth surface of the Hudson ahead of her, setting it glittering. She watched it for a second, then turned to see which way the Tutresh statue was facing this time of day.

It stood on a square pedestal, squat on squat, its crystalline structure opaqued by methods only Tutresh Artisans knew. Its face always moved with the course of the sun, though with Tutresh physiology, it was sometimes hard to tell. Right now two of its compact arms reached toward the lowering sun, while a third stretched skyward, toward its homeworld.

Reyes didn't stand contemplating long. Her job wasn't to philosophize about her customers. She turned her back on sun and river, and walked back through Legation Park toward a transit node.

A heavy slapping sound approached from right and behind. Reyes knew the footfalls, and turned to greet the Kron chasing after her. "*Iita, mou-ron Va,*" she said, recognizing him from his belt pattern. "Can I help you?"

"You have conducted business with Tutresh," Va said, his natural squawk combining with wing flapping to give an exaggerated appearance of agitation. The huge leathery flaps on his back were actually for temperature regulation, but humans couldn't help thinking of them as wings. "Business, true?"

"Not that I'm obligated to say, but yes."

"I wish to bid for your services. Immediate, high value."

"We'll be away from Earth for about two months, Va. You're welcome to hire us when—"

"No, immediate. I will outbid Tutresh, twelve sixty-fourths. Sixteen."

Reyes began walking again. "I won't break contract with Tutresh, any more than I would break one with you. If Kron are so eager to hire *Brent*, why didn't you contact me before Tutresh did?"

Va's wings fluttered, as a cloud crossed the sun. "I did not know other arrangements before you came to city. I will compensate now, with twenty sixty-fourths bonus."

"No deal, Va, but I hope we can do business again another time."

He fell behind, then began slapping away. Reyes doubted they would be doing business soon. Fortunately, her deal with the Tutresh would be bountiful enough to compensate. Not that there weren't disadvantages, too.

Reyes flew into Bern while it was still dark, got a short ride to the spaceport, and walked to the *Margaret Brent's* slip. Lights came on as she entered, pallidly illumining the light freighter.

It looked small. Eighteen months had passed since she left the *Cortelyou*, but she still kept comparing the ships. Smaller, older—but *hers*. Hers if she could keep it, which it now looked like she could.

"Good morning, Margaret," she said at the crew portal. It promptly slid open.

"Hello, Captain. All crewmembers have responded to your recall order. Looks like you need some sleep."

"I got enough on the suborbital." She boarded a lift for her quarters, and slumped against its wall as it rose. "A shower and new clothes, and I'll be fine."

"Captain, I believe you're lying to me."

Older computers had advantages and disadvantages. Experience with humans often let them gauge mood and veracity accurately. This was one of the—well, it's both, Reyes decided.

"I'm lying to myself, Margaret. You're just there when I do it." The lift opened. "I'll sleep when my work's done."

The cargo hold opened promptly at 0730 with Captain Reyes inside to greet the delivery people. If not revived, she

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was at least fortified. She directed the loading from a checklist she held onto even in those moments when sleep almost overcame her.

"Captain, what is this?"

Radha Natarajan walked across the deck, quite vexed. "Just some early loading," Reyes said. "Nothing that required you."

"Aren't I manifest officer? Didn't you hire me to perform these duties?"

That she had, a scant five days ago. "My recall asked everyone to be ready for duty at eight. Since it's earlier, I—" She studied the tiny, round-faced woman, looking like a betrayed child. "Actually, you're right. I'm sorry." She handed over the manifest. "Carry on."

Natarajan did that, though some of the items made her pause. The racket of loading soon brought the rest of the crew down to investigate.

"Oy, I thought we'd get a little more sleep-in." Nick Hardy was the junior technician aboard—tall, broad, fair, and blustery. He handled maintenance of Margaret, though how they got along baffled Reyes. "Here, Radha, what're these mates loading?"

As he read over her shoulder, the senior engineers arrived. Kayah Mon vigorously rubbed sleep from her dark eyes, while Zheng Zifei stood as taciturn, and bald, as a marble bust. Both had followed Reyes from *Cortelyou*, to her gratitude.

"Loading so soon?" Mon said. "Are we lifting off this morning?"

Reyes shook her head. "Not that early, and most of this isn't cargo. It's refitting supplies."

While they looked over the materials, Sal Almeyda stepped quietly to Reyes's side. "Looks like I'm last one here, Captain," he said, his tan face placid as usual. "What have I missed?"

"Nothing yet." Her executive officer's natural calm stood in relief against the rising bustle. "All right, my crew over here. I'm going to explain things."

They made a semicircle around her and Almeyda. "We have alien passengers, I presume," Zheng said in his usual low, detached voice. "We are loaded for an interior refit."

"Yes to both. We have another commission from the Tutresh. This time, we're conveying two of their diplomatic personnel back to their homeworld."

"Us?" Hardy said. "Why not do it themselves? They must feel pretty trusting."

"That's the impression I received," said Reyes. "They look ready to make their periodic contracts more permanent. The payment they're making for this run certainly suggests that."

"Payment?" Almeyda asked. "How much?"

"I'll discuss specifics with you later, Sal, but it's enough to put this ship on a much firmer business footing."

"Enough for us to install an iridium condensate drive?" Zheng asked.

Reyes smiled grimly. It had nearly sunk her in debt to convert *Brent* from its ancient cesium engine. "Let's not get carried away." Now came the hard part. "There is another reason they wanted a human crew. We're making an intermediate stop along the way, for an exchange of cargo."

"Another colony run," Hardy whispered, thinking himself unheard.

"No." She took a breath. "It's a world inhabited by primitive sentients . . . named Kuess. Zifei, Kayah, you know the place."

Mon groaned. "No, not there. Not *him*."

"Who?" Natarajan asked.

"Oswald Pitt," Zheng answered, the wrinkles around his eyes deepening. "We will tell you all about him later."

"No, I'll tell you now." Reyes might be able to forestall the worst stories. "Pitt was intermedia officer on my old ship, where I was executive officer. He . . . had a knack for unpopularity."

"He had a knack for intolerability, Captain," Mon protested. "We're well rid of him."

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"So now he's living on this alien planet," Natarajan said. "Was he put off?"

"No. Well, yes, partially. He went of his own volition, but only after Captain Vehra fired him." Reyes shook her head. "I'm explaining this badly. He's somewhere he wants to be, and I'll leave it there."

Zheng still wore a sour face. "What business could we have with him now?"

"Not us, the Tutresh. They're bringing him supplies, he's giving them an updated lexicon of the local natives' language. I—look out."

They scattered before a large crate being loaded into the hold, and reconvened near the door. "Is that why they picked us?" Hardy asked. "Because you know this mate?"

Good question. "Honestly, Hardy, I couldn't tell you. Now, I have to go meet the Legate we're transporting, in person. I don't know when it and its companion want to leave, but I want their room refitted for Tutresh necessities and comfort as early as possible. Mon, Zheng, you know I hate to ask. . . ."

Reyes had offered them the captain's cabin as inducement for signing on. She occupied the first mate's room, while Almeyda made do in crew quarters. "Could we confer for a second?" asked Zheng.

"Certainly."

Zheng reached for Mon's hand, but was really connecting his wrist port to hers. The interfaces they employed professionally to commune with the ship, they now used for their own intimate communication. After a couple seconds, Zheng's eyes came back into focus. "We agree, Captain."

"On one condition," Mon said. "That we don't have to have anything to do with Pitt."

"Agreed," said Reyes. She had expected as much.

"Unacceptable, Captain. Alter the arrangement."

Reyes's pace almost faltered, again. The Legate—named Setrell, though it preferred Legate—had insisted on conferring on a walk around the Tutresh embassy compound, rather than inside a building. Not only did low clouds threaten rain every second, but the Legate complicated her job almost as regularly.

The Legate's conical form peaked at waist level, with four thick, ashy-brown arms evenly spaced around the body. All sixteen fingers twitched with agitation at her incompetence.

"Legate, captain's quarters are the largest there are on our freighter. Expanding them would take time."

"You fail to communicate." She felt a jog, the Legate's broad lower body bumping against her. Had it done that deliberately? "We require small lodging together. Can you provide this without delay, or shall we dissolve this arrangement?"

"No! I can provide a small room, easily. My apologies. We did fail to communicate."

"Incorrect. You failed."

This time she stopped, as tact warred with ego, and eventually won. The Legate halted, but having full-circle sensory apparatus, did not need to turn around. The voice from its translator box nearly covered its natural whistles, snaps, and clacks. "Is there further difficulty?"

"There may be," she said tentatively. "You will have translation programs for *RRoduhim*, right?"

"We have them. You will also have them, by agreed terms."

"I assume you will also be able to conceal your translation devices?"

The Legate stopped short, and stunned Reyes by quaking, like a miniature volcano trembling before an eruption. "Unthinkable. Display is inviolate."

She winced. Attire of station was a Tutresh obsession. Setrell would no more wear something other than its Legate's robe, gray with black dumbbell shapes somehow representing diplomatic interaction, than she would go naked

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with her buttocks painted purple. Translators had to be part of the attire, and she had just suggested that it strip.

"I would not suggest that you violate your station," she hastily said. "You do understand, though, the Kihoa intensely dislike technological displays. The Tutresh were first to learn that."

"Kihoa act unreasonably."

"Perhaps, but they will act predictably."

"Predictably unreasonable." The Legate began scuttling along again. "The Recorder and I will board your vessel at zero two two seven, human time. Our conference is concluded."

He scurried along, toward the lumpy metal excrescence that was its embassy. Reyes didn't linger to watch him recede. She got into Bern proper, and found the nearest combooth.

"Margaret, stop the workers. They're to leave those quarters alone, and refit the vacant crew cabin for the Tutresh."

"They have already started refitting. One moment. I have informed them. They are irritated, and speaking of overtime charges."

"I'm not surprised. Get Zheng and Mon to help them. As for me ..." One hand reached absently for the other wrist. ". . . Inform Mister Almeyda that he's in charge of the ship until further notice. I . . . have an appointment to make."

She returned to *Brent* late that afternoon, ready to collapse into bed, but fearing the workers had inadvertently replaced it with Tutresh baskets in her absence. She went to crew quarters to give the construction foreman instructions on finishing early, then went to the hold.

Natarajan was double-checking inventory there. Pitt's supplies had one stack, the Tutresh luggage another, the renovation supplies a dwindling third, while a miscellaneous batch took up one small box. Reyes went to that box.

"Six doses," she said to herself. "Not that everyone will participate, but better safe."

"Might I ask about that, Captain? Why would we need mutagenic therapy for perfect pitch? That isn't even in civilian catalogs."

Reyes grasped a vial. "The Kihoa, the aliens Pitt lives with, have a language that requires perfect pitch to speak properly. He has it naturally."

"So that's why Margaret ran that test on me this morning. I guess I failed."

"Everybody aboard did," Margaret added. "The engineers could pass, if they were plugged into me at the time."

"They don't have that option," Reyes said. She resealed the box, still holding the vial. "Margaret, did you ask the engineers—"

"They all refused."

"Even Hardy? No, of course." Reyes held in a sigh. "Radha, could I ask—" Natarajan was already shaking her head. "They told you about him already?"

"True, but I would not take that hearing therapy under any conditions, Captain. I'm sorry."

"Say no more." She was almost out the hatch before remembering to dismiss Natarajan.

She spent as little time in her cabin as she needed. It didn't pay to linger on what she had to do. "I want daily tests," she told Margaret as she marched out toward the bridge. "Let me know exactly when it's taken hold. And call Almeyda to the bridge."

"Already here," he said as she walked in. "What do you need?"

"Standing launch clearance." She sat down at the helm, and began plotting courses. "The Tutresh are arriving at two thirty tonight, or this morning. I want to be ready."

"They couldn't possibly want us to launch then." He still began working his controls.

"Call it a hunch, Sal."

She opened the portal at two twenty-six, just as the Tutresh walked into view.

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"Are our belongings loaded, Captain?" the Legate said, its artificial voice reverberating.

"All of them, Legate. Welcome aboard the *Margaret Brent*. I have not had the pleasure of meeting your companion, the Recorder."

"You have not." That apparently said it all, as the other Tutresh, wearing white scribbles on gray, added nothing to the Legate's declaration.

Reyes had to precede them into the ship, as their broad bodies filled most of the corridor. "We have your room prepared. I'll happily explain anything you do not understand."

"Your inferiors may perform this service. You will launch now, Captain. Which way to our lodging?"

"The ... ship's computer will direct you, Legate. Board this lift, and—"

The Legate muscled past her into the lift. "Please follow, please follow." The Recorder squeezed itself inside. "Not you," it said when Reyes took a half-step forward. "Close." The door did.

Margaret spoke archly. "When it asked for an inferior, I see I was your first choice."

"Not now, please. Call everyone back to duty. Sal to the bridge, engineers to Engineering, and ... send Radha to the Tutresh quarters, in case they need anything."

The lift returned for her, and she rode it to the bridge. If Margaret heard the groan that escaped the stranglehold of Reyes's throat, she did not mention it.

Reyes and Almeyda had the ship airborne within five minutes, in orbit in fifteen, and boosting on a course for Kuess in forty-five. The Legate called the bridge only once in that time. Sal took the call himself, seeing how Reyes's face crumpled when she heard its voice.

"He's satisfied now," he said, gaining a stare from the captain. "Sorry, 'it'. Guess I assume someone that bossy must be male."

"I'll take that compliment," Reyes said. "Margaret, double-check my FTL course computations."

"I did so before launch, at your request. The course is accurate."

"Oh." She wanted to rub her eyes, but didn't. "Then go to tachyon drive at your convenience."

"Acknowledged." Seconds later, the viewport showed a flash of FTL space, then went black to protect human eyes from the disturbing sight. "On course for Kuess, Captain."

She sighed, and heard it echoed by Almeyda. "Have the crew stand down, Margaret. That includes Natarajan: if the Tutresh need somebody, they can come to me." She turned her chair. "You can get back to sleep now."

"What about you?

"Somehow, I don't think I'll get back to sleep. You turn in. I'll keep watch."

Almeyda hesitated, but left. Reyes began counting under her breath. At one hundred forty-seven, the Legate's voice barked over the comm system, eliciting an only-too-wise nod.

The first two days were hardest. Satisfying the Legate's demands was only half the work. Informing her crew of them, and calming their objections, was nearly as hard.

The Legate demanded exclusive access to the mess room at certain times, times that didn't mesh with the human diurnal cycle. Reyes halfheartedly suggested they eat in their quarters, and took a wholehearted rebuff. Margaret ended up informing the crewmembers each morning when they could or couldn't eat.

They could have figured it out eventually from the lighting schedule. Public areas now went bright or dim on Tutresh diurnal rhythms, cycling each nineteen-plus hours. Margaret did restore the lights to a human visual spectrum when they weren't around, but that was the extent of concessions the Legate made.

The lighting of public areas was moot, though, when one could not use them.

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The Legate had firm demands about that as well, and whenever those demands came in conflict with the human crew, relations hid their nadir.

Captain Reyes was walking back toward the engineering space when there was a sudden clatter over her head. Nick Hardy descended noisily down an emergency ladder, dropping to the deck right at her side.

"Hardy!" She regained her breath. "I had forgotten that ladder existed until now."

"Yeah, well, when the Tutresh announce they're emerging, and to clear the corridors, your memory gets jogged. Heading to Engineering, too?" Reyes nodded. "I know you're doing your best, Captain, but it's like living with the Devil and his longtime companion. You don't suppose—"

"Don't speculate, Hardy. They're guests, and it's impolite. Tell that to the others, too."

"Gotcha." He followed Reyes into Engineering. Zheng and Mon were linked to the engine subprocessor, and each other, at the far end of the room. "I hadn't mentioned it before, Captain, but I think Radha's working out real well. I've been helping her fit in wherever I can, and—"

Reyes pulled up short. "Maybe you should be a little less fervent in your assistance. Let her adapt herself."

"Captain, there's no harm in offering a hand."

"I disagree." Her hard tone froze Hardy. "She should deal with us on her terms, no one else's. I suggest you rein in your attentions. Understood?"

Hardy's face ran through several emotions, before fading into acquiescence. "Done, then. Excuse me." He stepped through the computer center door.

The tense mood Reyes had created stayed with her. Hardy wasn't a bad man, but he lacked tact and refinement. He didn't know when to stop pushing—and she worried that he was pushing something more than friendship.

Radha had plainly never undergone genetic therapy: nobody chose to become a meter fifty tall, and few chose to remain so. It advertised timorousness, fatalism, resignation. Such a woman could be trampled, exploited.

She had seen enough of that in years past. Not on her ship. Not under her command.

"They did what?"

Mon almost told Natarajan what, but a gentle touch from Zheng stayed her momentarily. Reyes picked that moment to walk into the mess. "Does it always turn quiet when I walk in?" she prodded gently.

"We were discussing the Tutresh," Natarajan said, "but I think they'd rather not go on."

"No," Zheng said. "I meant to raise it with you, Captain. Both of them came to Kayah and me, and began interrogating us about . . . our interface."

"They what? And both of them?"

"That struck us funny, too," said Mon. "It's the first time the Recorder's said more than three words to anybody."

Reyes began heating up her meal. "May I ask what you told them?"

They glanced between each other, and almost casually linked. "Some," Mon said, "before the shock wore off, and they started asking about sexual practices. Human, and personal. Then we explained that we felt uncomfortable, turned it around by asking how they'd feel if we asked them those questions."

"They would be angry," Zheng added. "It did not deter their inquiry."

"We don't want to insult them." Mon grimaced. "Actually, I do, but I don't want to hurt our business arrangements. How do we say 'no' without making matters worse?"

Reyes's face grew a frown. "I'll have to think about that." She retrieved her food and sat next to Natarajan. "Have they given you similar trouble, Radha?"

"No, just the same trouble they give everybody."

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"Good. Do feel free to come to me if there are problems. I should have said so earlier."

"Thank you, Captain. I may do that."

Reyes ate in silence for a few moments, but Margaret broke the mood. "The Tutresh are coming to the mess. They require your absence."

"What?" "It's not their time." "I'm not finished."

"Settle down, please," said Reyes. "Let's just retreat in good order." They started filing through the door, Reyes hanging back to exit with Zheng and Mon. "By the way, if they ask again, you don't have to say anything."

A piano played with hesitant rhythm, barely carrying its theme to a small crescendo and decrescendo. A reed joined the theme repetition, followed by more of the orchestra. The piano still dominated, though, and with the force of more instruments behind it, drove its crescendo higher and louder, then faded away to nothing.

Just as the orchestra began building on its own, Margaret spoke over the recording. "Mister Almeyda wishes to enter, Captain."

Reyes grunted. "End playback, and open up." She got out of her chair before Almeyda walked in. "What can I do?"

"I thought we could talk, Captain." He made sure the door closed behind him. "The last week has been rough, on you especially. I'm concerned that you're wearing down under the strain, and I'm offering to shoulder some of your burdens."

She tried to look gracious. "That's a noble offer, Sal, but I've managed so far. I'm captain. I'm supposed to do this."

"I'm your first officer, Noemi. I'm supposed to help you."

The first name was a signal. She looked him over carefully. "You know I like doing as much as possible. Any good captain should." Her last one hadn't. She did all Vehra's donkey work, and did not want the precedent recrudescing now that she was captain.

"I want to do something. Heaven knows there are some pressures involved here I can't relieve."

"What do you mean?"

Sal fidgeted. "Mind if I sit?" Reyes waved him to a chair, and politely took one herself. Sal didn't look relaxed until she sat down. "I saw how you looked before we made this deal, like you were getting in way over your head."

"With *Brent's* finances, I always look that way." She halted, aware of having revealed too much too casually. "Tutresh aren't my favorite customers, but I need this deal. We can flirt with insolvency only so long. I need to do what's best for the ship now, because there might not be much of a later. When later does come . . . I'll think about it then." She braced. "You may commence your lecture."

"No, I didn't come to argue business. I'm more concerned about crew morale. They have some personal concerns, not only about the Tutresh."

"If you're talking about Radha and Nick, let me handle that. I'm more experienced with that than I care to recount."

Sal blinked. "I wasn't talking about them . . . although Nick does have the impression you're trying to separate him from Miss Natarajan."

"True enough."

He gritted his teeth. "And that you're . . . reserving her."

Reyes was silent for an ominous second, then leapt from her chair. "What? Sal, that is so comprehensively offensive I barely know where to start. I don't tolerate using professional power to coax or coerce sex. That stands for Nick, and it stands for me!"

Sal had risen to match Reyes, and was giving ground to her menacing approach. "I understand, Captain," he protested. She checked herself. "You've expressed that opinion before, though never as explicitly." Residual sadness re-

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mained as the intensity of the moment faded. "Nick isn't exactly in a position of authority over Radha, though."

"Everyone has seniority over her. Someone needs to look after her interests, and before you say it, I don't trust her to do it effectively herself." Fatigue struck her that moment, but she fought the urge to drop onto her bed. "This isn't even what you wanted to discuss. What other personal concerns do they have?"

Sal remained standing too. "Well, they're worried about our stop on Kuess, meeting the Kihoa—and Oswald Pitt."

Reyes groaned. "*They* don't need to worry. They want no part of him, so I'm handling it. Me and the Tutresh, for whatever that's worth."

He nodded, and maneuvered himself back over the seat, holding one armrest. "I know as much of your first visit to Kuess as the engineers have told me. Pitt having to translate for you, making trouble for your captain, driving the crew mad—"

"Nothing unusual for Oswald."

"—that affair he had with the local leader's daughter—"

"No! They assumed that, and that's partly my fault. Imsah loved him; maybe he loved her back, but as for—ugh." She sat on the bed's edge. "Poor Oswald was right. Lies have outlived the truth."

He regarded her. "I was getting to this. You acknowledge his faults, but don't regard him nearly as harshly as the others."

"Because I started seeing other facets of him. Why he isolated himself, his passion for premodern music . . ."

"Which you've picked up yourself."

Reyes looked up sharply. "How did you know that?"

"I hear it occasionally, passing by your quarters. You were playing some before I came inside." He saw her arms close over her chest. "It's no secret. That, or where you picked up the habit."

She found a spot on the floor to scrutinize. "You probably can't make sense of that music, can you?"

"It's . . . definitely not modern."

"It goes by different rules. A lot like Oswald, I suppose." She met his eyes again. "The piece I was playing before you came in—"

"Yes?" Sal politely veiled a twinge of distaste.

"It's—" She couldn't find words. "Actually, it was meant to be diagnostic. The perfect pitch therapy is finally working, Margaret says—" She deflated slightly. "—which means tomorrow I start language lessons."

Concern crossed his face. "You plan on learning their language in eleven days?"

"Margaret will be able to teach me . . . directly." She touched the uniform material at her wrist. "I promised myself I'd never get one of these, but needs must when the Tutresh are acting their predictable contrary selves." She twitched, and pulled her fingers away. "Still hurts."

"You . . . were talking about a musical composition."

"I was." She straightened her carriage. "The *Concerto in F*, by George Gershwin. Oswald's favorite composer, I believe. I'm positive you've never heard of him."

"Sorry."

"A shame. Gershwin's *Concerto* is disjointed, even by premodern standards. The parts don't come together easily. It's often dissonant, hard on the ear. On first hearing, it's an unpromising piece . . . but it draws me back. There's a complexity to it that doesn't yield to casual attention. I've listened to it a dozen times. I keep suffering through some parts. Still, I comprehend its depths more each time. Someday, I intend to get past all the discords, and reach its full meaning."

Sal's mouthed quirked. "And you think of Oswald the same way?"

Reyes smiled. "Precisely, Sal. You understand."

"Not completely. I suppose I'll keep

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working at it, like you." He sat at Reyes's side, gauged his distance, and moved away an inch. "Noemi, you don't have to do this alone. Whatever help you want with the Kihoa, with Oswald, you can rely on me."

"It's too late for you to take the hearing therapy, Sal." His face fell, making her rue her tone. "I do appreciate the offer, but I've already put in the work. Besides, crazy as my crew might think me, I do want to see Oswald again."

"If only to figure him out."

She nodded. "Yes, if only to figure him out."

Dawn was creeping over the distant hills. Most respectable Kihoa in town were still abed, but Oswald Pitt noted sardonically that he was neither.

He walked the borderland between *Choge* and the surrounding fields, contentedly alone. The brightening sky held him but for a moment, as his mind turned back inward. He had promised himself to finish the first act that day, and he never shirked his duty.

Even when it involved juggling three languages, one of which he barely knew.

"Play." The fist-sized computer under his long shirt heard his command, and began transmitting audio into the bead tucked into his ear.

"*O soave fanciulla . . . (Trovò la poesia!) . . .*"

"Stop." He could discard Marcello's repeated offstage aside. *O ghihhu duhim o*—"He has found his voice"—worked with the first one, but wouldn't match the second one's notes.

Now, "*O soave fanciulla.*" Seven syllables was too long for the concept. *RRoduhim* was usually more compact than human languages; the pitches gave it another dimension. But he could elide equal notes, turning seven into four. *Nim ria o* covered it, with the added "my" barely altering the sense.

"Play."

"*. . . o dolce viso di mite circonfuso alba lunar . . .*"

"Stop." Fifteen notes, condensable into ten—no, twelve max. Another "my" to exploit the repeated A flat—or what was before compensating for the Kihoa tonic . . . a minute of pacing, and he had something usable. *O dehhim firr ne presa ihpar deka o.* "My senses reel from your dancing, starlit eyes." Kuess had two nondescript satellites: the poetic beauty of moonlight never occurred to them.

"Close enough for opera," he said. "Play."

The next passage flummoxed him. Five equal notes, then eleven covering ten syllables. "*Maledetto Puccini,*" he growled, not for the first time.

Five playbacks helped him chip at the problem, but it was in tortured silence that he broke it. Once more he played it, and sang along. A few Kihoa looked up in curiosity, but they knew this outsider's habits. Oswald didn't notice.

"*Kanrru-u-un ne si o nimghe kantu ho-o-o ka-an du no kantu-u-u. Ya*—what the—! Stop!"

The Rodolfo-Mimì duet died aborning, but the falling note that clashed with their rising voices remained. Oswald looked around, but other heads were up. He followed them, and saw the spaceship crossing the sky, gliding toward the hills.

Frightened Kihoa began looking for safer ground. "Don't be alarmed," Oswald told them. "It's only humans coming."

He looked again at the ship, plainly built along human lines. "Humans," he repeated, and spat into the ground. "Why do they always make their appearances first thing in the morning?"

Oswald headed back into town, calming Kihoa wherever he could. The *Kiahimado* likely knew already, and would want to send a greeting party. No prizes for guessing whom he would send.

The hatch drew away to reveal a dry valley, with pale plains visible beyond a

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pair of hummocks. Captain Reyes hoisted a satchel onto one shoulder. "Do we have everything?"

Natarajan shuffled from person to person, marking off items on her manifest. "Yes. All of Pitt's goods. Are the Tutresh going with you, Captain?"

A scuttle behind her answered the question. "Aside, worker human. Captain, we await the excursion."

Reyes looked at the top of the Legate's robe. A short mantle, tinted to match its robe, hung over its translator collar. The Recorder had the same arrangement.

It wasn't thorough, but it would have to suffice. For all their reproach of any possible interference with the Kihoa—the Interdiction Major (Modified) was their restriction—they took few enough pains themselves.

The Legate walked up to Reyes. "Will you act, Captain, or must we convey these parcels ourselves?"

. "No. No, we were gathering them when you arrived. Sal?"

Almeyda passed her a box that thumped when tilted, then picked up a heavy carton with a smaller one perched atop it. It was a computer and memory bars, and Reyes had a good idea what was stored in those bars. "Ready, Captain?"

"Ready. Radha, close up the hold after us." She shifted the digging strap, and walked. The two Tutresh rapidly took the lead, which she diplomatically ignored.

A heavy atmosphere pressed around her, but only made her skin uncomfortable. She had treated herself already to compensate for the atmosphere and higher gravity. The whole crew had, save for Radha. She still meant to ask her, but had been reluctant to interfere, after her first misstep.

Not that she had much time for nosiness lately. Language studies had devoured her time more completely than she could have imagined. Her responsibilities rapidly went begging, a situation alleviated only when she relented to Sal and passed on most of her duties.

Despite full immersion and computer assistance, she still felt her progress inadequate. Maybe one needed a certain type of genius to pick this language up as fast as Oswald.

Oswald, a genius. Not the first word she would use, never mind anyone else.

They were well along a familiar dirt road, passing fields burgeoning with rising stalks and spreading leaves. A town loomed ahead, and when Reyes concentrated, she spied a pair of figures approaching them.

One had a peculiar long-legged gait, unarguably Kihoa. The other didn't seem unusual—and here, that meant one thing.

"Pitt's in the group ahead," Reyes said, quickening her pace to pass the Tutresh. "Let me speak with him. He knows me."

Her pace outstripped argument and gait alike. She slowed only when Pitt was close, to regain her breath. She wanted the first word, and she had practiced it.

"Greetings," she sang out to both of them. "It is a pleasure to walk your roads again."

Oswald stopped short, though his escort went some more steps ahead. "Can't you speak English?" he sneered in his first language. "You sure can't handle *RRoduhim*."

Reyes and Oswald's escort both looked at him with similar expressions. The Kihoa growled something, apparently not language. "You'll have to forgive Ghiri's testiness," Oswald added. "He expected to run this meeting."

She looked at Ghiri, who was eyeing her warily, and the Tutresh more so. "He should have known better," Reyes said, back in English, "with you on hand."

"Miss Reyes, that's the nicest thing anyone's said to me all day." He looked over her shoulder. "Captain Vehra didn't care to see me again, then. Tell him I appreciate his absence."

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"He's more absent than you think, and that's *Captain* Reyes."

She inspected his appearance while that shock sunk in. His lanky frame hadn't thickened under the stresses of higher gravity. His appearance was neater, but still peculiar. He wore Kihoa materials, but not in their styles. Where Ghiri wore a singlet and kilt, Oswald sported a long shirt and pants, and his boots contrasted sharply with loose Kihoa shoes.

"He didn't let you buy him out," Oswald deduced. "Was it mutiny, I hope?"

"I bought my own freighter." She latched on Ghiri to change the subject. "You should introduce me to your companion."

"Oh." He spoke in *RRoduhim* to Ghiri, which Reyes followed, then repeated himself in English. "*Ahimado*, this is Captain Noemi Reyes. Captain, this is *Ahimado* Ghiri Omadu."

They exchanged niceties in his language, Reyes carefully enunciating. "*Ahimado?*" she asked Oswald. "What happened to the Overlord, Yaru?"

"Nothing. He appointed a deputy to help administer his hometown. Anyway, since you brought the Tutresh along, or vice versa, I'm guessing they've finally brought the things I requested."

"We have fulfilled your requisition." The Legate bumped past Reyes. "For future replenishment, you must provide the updated lexicon."

Oswald glared downward. "You'll get it, not that your Philosophers bothered lifting a back arm to help its compilation."

"You required no outside assistance. Failure is your responsibility."

"Don't call me a failure—"

Reyes squeezed in between them, pressing closer to Oswald than she liked. "Is there trouble with your translations?"

He scowled and stepped back. "No petty sabotage that I couldn't overcome." Ghiri caught his eye, and inquired forcefully about something. "He asked if you're coming into town."

"I understood him," Reyes said, feeling the strap biting her shoulder again. "We are, unless you want me to leave your parcels here on the road."

"Hardly," he replied, with a heavy snort.

"Agreed, then. *Ahimado*, your escort to town would honor us."

Ghiri looked their group over again. "You speak for the Tutresh?"

"*Di.*" Yes—and she hoped they didn't object.

Ghiri gave Oswald a hard look. "Let us bring them," he told Oswald, and started back along the road to *Choge*.

Oswald followed, head craning over his shoulder. "Let me do the talking from now on," he told Reyes before leading them forward.

Reyes walked on, soon finding herself joined by Almeyda. "He and the Tutresh deserve each other," he observed softly.

"Shh!" She glanced anxiously, but neither party had heard. She marched along in silence, wondering whether satisfying her curiosity would be as satisfying as she had anticipated.

The crowds watching them had changed. Reyes could sense a different collective attitude from the first time she had entered this town. Kihoa were more bold in showing themselves before the procession. Some showed curiosity and wonder, but the gestures of others showed opinion had moved away from fear in both directions.

The Overlord's manor loomed, its two stories rising over the single levels of the rest of town. "Do you live near the Overlord, Oswald?" Reyes whispered ahead.

"I live with him." Reyes and Almeyda exchanged looks. "He was very generous to take me in. I hope I'm making it up to him." The surprise shifted from Reyes's face to Almeyda's.

A figure appeared in the manor doorway. Reyes recognized Yaru Ihham instantly. Ghiri motioned them to a halt, and spoke to Yaru. "He's saying we come with honorable intentions," Reyes

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told Almeyda, "and that he will guarantee our good behavior."

"Guarantee like vouching for, or like enforcing?"

"Both."

Yaru made a brief oration, more for show than content, welcoming the visitors and giving Ghiri his thanks. Reyes gauged the proper moment, and advanced toward Yaru.

"Overlord, greetings. I am Noemi Reyes, now captain of the *Margaret Brent.*" She hesitated. "I must apologize for our hasty departure the last time we came to your world."

Yaru cocked his head. Reyes briefly thought he was going to critique her verbal skills. "I recall," he finally said. "Your crewmate explained the circumstances. I need no apology."

Oswald looked unconvincingly innocent. Whatever tale he had spun, though, it didn't count against her. "Thank you. Allow me to introduce my sec—"

"Overlord Yaru." The Legate had made a perfect end-run around Reyes, with the Recorder close behind. Reyes's mouth hung open, half a word left inside. "We have important discussions to conduct. What is your earliest opportunity for a meeting?"

Yaru tensed, eyes divided between the two alien delegations. Reyes alertly came to his rescue. "Mister Almeyda and I have goods to give Oswald. We can postpone our formal introductions, if the Tutresh have urgent business."

Her concession didn't relieve Yaru as she had hoped, but he took it. "We may meet now. Ghiri, attend with me." Ghiri quickly got the same look as Yaru, but followed when beckoned.

They all entered the vestibule, a previously unseen guard shutting the door behind them. The Kihoa and Tutresh turned into the meeting chamber. Reyes watched the Legate maneuvering the Recorder through the door, then squeezing itself through. How would they handle Kihoa furniture, she wondered with a touch of wicked amusement.

"Captain," Almeyda asked, "could you run me through what happened?"

She gave him a synopsis as Oswald led them up the stairs. Almeyda's brow wrinkled at one point. "My thoughts exactly," Reyes said. "The Tutresh forbid most interaction with the Kihoa, so why would they need discussions so urgently?"

"Tutresh are masters of the double standard." Oswald wasn't content with passive eavesdropping. "They trust themselves to act properly, but make rules for everyone else. I had to spend weeks with them before coming here. I should know."

Reyes nearly snapped at him, but a call of "Oswald" stayed her. The name was distorted, spoken by a tongue not taught to build sounds that way.

Oswald turned toward the approaching Kihoa. "Imsah, what is it?"

Reyes held Almeyda back on the step below the landing. She answered his swift, questioning look with a nod.

Oswald and Imsah spoke for a minute. She parted somewhat reluctantly, and Oswald's eyes followed her down the hall. After a suitable pause, Reyes climbed the last stair and turned right, the way Imsah had gone.

"This way," Oswald growled, pulling her around.

"Sorry. I—sorry." Explaining what she had assumed would be worse trouble.

Almeyda drew even with her. "What did they say?" he mouthed.

"I didn't follow." She looked away. Imsah was hard to understand—she never got her starting note right—but she had wanted Oswald's help with some weaving, and Oswald had gently deferred her. Reyes didn't need to know, and Sal certainly didn't. Bad enough that she had mirrored Oswald's casual prying.

Oswald's room was at the end of the hallway. It was spare, with a roughhewn human-style chair in one corner and a thin bed in another. Small tapestries hung on opposite walls. Two heavy bureaus stood along the nearest wall, several of their drawers barred.

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Leather-bound volumes covered the top of one.

"The Tutresh left me explicit instructions to update their knowledge of this language. They didn't leave me anything to do it with. The one computer they let me keep can only read, not record. Put those anywhere."

Reyes shrugged, letting the satchel fall onto his bed. "They did bring these," Almeyda said, offering his armload to Oswald.

"Lemme see." Oswald put aside the memory bars, and yanked open the other box without taking it out of Almeyda's hands. "Finally! Wait, I see the catch. I record their lexicon on this, and they take it home with them. How Tutresh of them."

"I heard nothing about that," Reyes said. "To my knowledge, it's yours to keep."

"I'll believe it when you take off without it." He hoisted a book to make space for the computer on one chest. "That won't be for a while, since I've got to dictate all this into memory storage."

He riffled the pages. Reyes caught glimpses of English, along with squiggles arranged on arrays of bars. Those gave way to unfamiliar patterns of lines and dots that had to be Kihoa. "Are all those books your notes?" she asked.

"Some." He shut the book. "One's a start I made on a neighboring language. Others are . . . other projects. Oh, I hope you brought decent clothes."

He ransacked the satchel, throwing various articles all over the bed. They were in human styles and fabrics, but coarse enough to pass on a technologically unsophisticated planet.

"And this." He opened the box at Reyes's feet, revealing books bound in hard paper. He thumbed through one, loaded with diagrams and figures. "Good." He put it on the floor, took out another, and ran through its blank pages. "Better. The Tutresh didn't see these, did they?"

"The parcels came to us sealed," Reyes said. "I don't know what they saw before we got them."

"What am I thinking? It must be OK." He refilled the box, unbarred a drawer, and stuck it inside. He opened another, but left it empty. "That'll be good for the computer, except I'd better start using it now. This is gonna take a while." He flipped through the Kihoa book again. "A couple days, or more." He looked up sharply. "And I don't need spectators."

Reyes didn't flinch. "I guess we're done here, Sal. We'll find our way out."

Oswald grunted, and hunkered down on the floor. Reyes looked back briefly, but left soon enough.

"He barely acknowledged my existence, Noemi," Almeyda said. "Is that good or bad?"

Reyes shook her head, downcast. "It's Oswald."

She expected a long wait, but Yaru was already free. She and Almeyda joined him in the meeting chamber, while Ghiri stood restively along the wall, shunning a slanted chair nearby.

"The Tutresh are ... insistent." Yaru was obviously bating his words. "They demand we conduct no commerce with space visitors, restrict contact to the least possible. They apply these demands to you as well."

"I expected as much," Reyes said, "and we shall abide by what they ask of us. Let us discuss how we can best meet their requirements."

Yaru's large mouth twisted. Reyes assumed he had an urge to say something impolitic about the Tutresh. She was half right.

"Shall I summon Pitt, to interpret for you?"

Her ears began burning. "He is occupied. Please, show me patience."

Ghiri strode up to Yaru, speaking too softly to hear. Yaru made a thrusting motion with his head, and Ghiri left the chamber. "He has other business," Yaru said.

Reyes didn't express her doubts. She

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had enough trouble painstakingly telling Yaru that she would be the sole human not restricted to the spaceship for their stay. Almeyda agreed readily when she consulted him, and she could not exaggerate her relief.

She left with her head spinning in perfect synch with its throbbing. She briefly spied Imsah speaking animatedly to a static Ghiri, but forgot about it. Examining their interactions wouldn't get her back to the *Brent* any faster.

She was on the road back to the hills, and her ship, before Almeyda spoke. "You probably don't need to return at all. Oswald can deliver his work whenever he completes it. Usually I wouldn't care to stay shipbound while on a planet, but I can make exceptions." He waited. "Captain?"

"You're welcome to. I might even do the same." She looked up as the sunlight disappeared. "Especially if it starts raining." She broke into a weary run.

The storm lasted long enough to soak them, and dissipated minutes after they reached the *Brent*. Almeyda thought he heard his captain say "Figures" as she went to change.

Reyes went to inform the crew personally of the restrictions, but each in turn said the Tutresh had already told them. She thought of speaking to the Legate, or even the Recorder if she could somehow get it alone. Once she considered her prospects of success, she abandoned the notion.

She returned to her quarters, and fell into a chair. "You appear markedly fatigued," Margaret commented. "Would you care to sleep now?"

"No!" said Reyes, too loudly. "If I get out of rhythm with the thirty-hour day here, I'll never get back."

"Your shipboard duties are currently light," Margaret said. "You can see to your physical needs with minimal effect, thus improving later efficiency when your attentions are more necessary."

"You make it sound so alluring," Reyes said wryly. She began drifting into thoughts of sleep—then jerked back. "One flaw, though. I have more than the ship to concern myself about."

"Trouble with Kihoa relations? Or perhaps Mister Pitt?"

Reyes didn't answer. One more attempt, one more sally against the walls of that fortress. She had found a way in once before; why couldn't she now?

"Are you leaving the ship, Captain?"

Reyes paused at the cabin threshold. "Yes, Margaret. Mister Almeyda's in command until my return. If he asks . . . tell him I had unfinished business."

The walk back was another hour, the air moist and heavy though the skies had cleared. Patches of brilliant color newsprung along the roadside tickled Reyes's eyes, but she stayed unsmiling, like a pouting child refusing to be amused.

Near the edge of town, childish shrieks struck her ear from behind. A Kihoa child ran past her, galloping on all fours, with a pack gaining on him. The quarry bounded across the rut on the side of the road, but stumbled. Most of the others tumbled into the rut, but one got over cleanly, smote the leader hard, and scampered away.

The struck child lay still. Reyes almost went to its aid, before seeing the others make their coups and chase the new leader. The fallen child then sprang up and joined the pack, all tearing after their prey.

Reyes walked on, disturbed for a moment, but reconciling herself. Soon the chase came her way again. The leader shot right past her legs. Most of the others saw her, and went skidding off to the sides, losing ground to avoid her. Their yelps finally faded into the distance.

She tried to shake that image, but it dug into her. She tried to ignore the looks of townspeople as she walked to the manor, but here a turned back, there a set of bared incisors drove themselves home. She found more accepting reac-

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tions when she looked, but always there were the others.

A guard met her at the manor door. "I am here for Oswald," she explained. He understood and led her inside, but she dismissed him at the top of the stairs. "I know the way."

Oswald's door was open, and she could hear his voice gently rising and falling. He was sitting on the floor, a book open across his folded legs, writing with an implement she didn't recognize. His steady voice soon gave way to snatches of notes.

"*Dammi il braccio—treti nahim . . . mia piccina—o rrudada . . .*"

Reyes watched him sing, speak, write—one after another—a strange expression on his long, homely face. When she recognized it, she couldn't believe it for all its simplicity. She had seen Oswald asleep, indeed, knocked out by analgesics and anesthetics. Until that moment, though, she had never seen him at peace.

His head jerked around, and the serenity shattered. "What?" he said, slapping the book shut so fast he caught a finger in it.

"I . . . came to ask a few questions, Oswald." She spoke softly, hoping to recapture the fleeting moment.

"Which involves standing around gawking at me?"

"When do you think your lexicon will be done?" she blurted out, the first thing she could think of to stem the deluge.

"Ha ha, really subtle. I worked on it four hours straight, before I remembered the real work I was doing this morning." He stretched a scrawny arm to pick up the Tutresh computer. "Want to look it over? Want to confirm I've actually done something?" She waved him off. "Right. If you need a number, call it day after tomorrow, probably late. Anything more, or should I start performing for you again?"

Her poise had evaporated. "I only . . . wanted to know how you were."

His face contorted. "What?"

"How you've adjusted to living here, among aliens."

He snorted hard. "I'm away from humans, so right away it's an improvement. Why are you pretending to be interested?"

That shot finally prodded her temper. "Why do you assume it's an act?" she barked back. If she had to start from scratch with Oswald, perhaps she wouldn't bother.

"Because I was a blight on your life. See, silence. You can't deny it."

"I can." One more try. "You shook me up when I needed it, spurred me to walk away from a bad business."

"You're talking about old Captain Aflab? You didn't need my help to ditch him. You just needed to rub two brain cells together."

"Oh? Where does that leave you? You stayed with him more years than I did."

"But as long as I suffered him, he had to suffer me. What's your excuse?" He untangled his legs and stood. "That's probably why you tried learning the language. Overconfidence. Just because you threw him off your back doesn't mean you can do it all."

Reyes was shouting now. "It means I'll do the job nobody else wants to. It means I'll have a gouge taken out of my wrist, just so I can understand, even if I can't speak to your satisfaction."

Oswald's scowl crumpled. "You got a port? You?"

"Me." She yanked down her sleeve. The language module had a fleshtoned exterior, and would pass casual inspection. Reyes gave Oswald a long look. "If I did this so someone other than the Tutresh could speak with the Kihoa, then maybe that means I have a little interest in what happens to you. Maybe it means I'm doing more than pulling an act, and—hey!"

The guard had returned, and had her arm pinned behind her back. "Wait!" Oswald shouted in *RRoduhim*. "It's all right. It was only an argument. Let her go, please."

He relented, warily, and moved off to-

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ward a knot of Kihoa who had gathered down the hall. Reyes didn't see faces, as Oswald pulled her inside his room and closed the door.

"Well." His eyes wandered around. "Well, that's doing your job. You always did that."

"I didn't always listen to premodern music," she returned. "You introduced me to a culture I barely knew existed."

"Listen?" he asked, still challenging. "Present, listen?"

Reyes smiled winningly. "I've even broadened my listening beyond your repertoire. Chopin, Beatles—"

"Beatles!?" He brayed with laughter. "Which, their self-indulgent juvenile phase or their self-indulgent avant-garde phase? There's nothing else." He softened. "Well, 'Yesterday' was good, but that's it."

"Fine, you're entitled to your opinion. I prefer Bach anyway."

Oswald's eyes rolled. "Ugh. Old-fashioned sawing and tooting. No thanks."

"Old-fashioned? You're the one who told me every composer was once modern."

"Did I? I take it back. Bach might have been new once, but he was never modern."

Reyes's eyes hardened. "I'm glad to see you're as tolerant of my musical tastes as I was of yours." His sneer almost wavered. "I thought that that, if anything, would be the path to your better nature."

"OK, three guesses which assumption there is completely wrong."

"Put away the act, Oswald. I don't know you that well, but I know better than that."

His face softened, but stayed challenging. "Really."

"Really. If you didn't have a better side, the Kihoa wouldn't have put up with you for over a year."

Oswald chortled softly, then hard and through his nose. "Just wait. They'll drive me into the hills yet." He picked up his book, still laughing.

* * *

Almeyda intercepted Reyes outside the mess hall. "The Tutresh are there, Captain."

"Oh, thanks." Her brow folded. "Margaret, why didn't you notify me?"

"Mister Almeyda anticipated me. He had apparently planned for your return."

"Really? Something you wanted to discuss, Sal?"

"I ... wanted to know what happened between you and Pitt."

"We talked. Contentiously to start, but things settled down." She headed for the lift, Almeyda following. "I'll be going back tomorrow afternoon."

"He may not appreciate the interruption."

"He invited me, Sal." She saw his face. "Yes, I was about that surprised."

"I—er, where are you going?"

"To my quarters, to eat. I stored away some rations for scheduling emergencies."

She entered the lift, but he held the door. "And then?"

"You'll be very pleased. Sleep. The long day here has one advantage. I can get in nine hours without guilt." She eyed him. "Will that satisfy your executive solicitousness for your captain's health, or will you need to watch?"

He recoiled. "I—trust you, Captain."

"Good." The lift door closed. "You wait, Margaret. He'll ask you whether I slept the night through."

"I will not answer such a question without your permission, Captain."

"Right." The lift stopped and opened. "Permission granted."

Reyes was barely inside the vestibule when Oswald came trotting across the tiled floor. "You're kinda late, but that's OK. Lost track of time myself. Well, don't just stand there."

"Are we going somewhere, Oswald?"

"Yeah, out." He held a bag in one hand, holding something about the size of one of the native books. "If the Overlord asks," he told a guard, "we'll be walking through town."

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She followed him out. "The Tutresh told us to make minimal contact."

"Don't worry about them. You're with me." He headed down the busiest street, waving her along. "So what did you want to discuss today? Let me guess. Music."

"That's a start, yes."

"A start and a finish. That's mostly what I do here."

Reyes finally caught up. "You compose?"

"Not really. I translate. I've got something of a following for my interpreted songs."

"Human songs, you mean. Older songs."

"Yes. I'm not exactly proficient in primitive labors, so that's really my one way of making a living." He narrowed his eyes. "You didn't think I mooched off Yaru's hospitality?"

"I—hadn't thought that far."

"Hmph. Anyway, there's enough curiosity about human music to support me. Enough songs, too. Gershwin's show tunes are great for translating. Joel's tougher: more emphasis on instrumentation, and Kihoa prefer *a capella*."

"He did *a capella* once."

"Once." They squeezed through a small crowd around an open-air vendor. Reyes felt eyes all over her. "He needs more cultural translating, too—though that hasn't stopped me with anyone. The last ten days, I've had—do you know Puccini?"

Reyes thought. "I think he's in the last bundle of music I purchased. Haven't gotten around to him."

"Get around to him. I'm translating *La Bohème*—getting real ambitious. If I translated directly, I'd be taken for a pervert." He looked back at Reyes nervously. "You know their customs about ... eating together, right."

"Yes." How could she forget?

"Well, that's all through this opera. Roommates eating together, a whole act at an outdoor café. Since this isn't *Hair* or *Body Politic*, I've gotta rewrite all that."

"So you are composing, then?"

"I guess so. Only lyrics. I don't touch the music, though I probably should."

"Because the notes are integral to the words," Reyes said. "If the word you need has a different tone, you better find a synonym fast."

"Right, or reorder the sentence, or find something different for them to say."

"You really picked a tough profession, Oswald."

He looked halfway around, slightly bemused. "Yeah, but I can't imagine doing anything else. It's more communication than I ever did on a freighter." He pursed his mouth. "That and Imsah's tapestries."

"Like the ones I saw in your room." Reyes cocked her head. "Communication, I suppose, but definitely not musical."

"Wrong. I'll show you when we return. It's visual representation of speech, or her interpretation of it. Well, speech and music, though Kihoa don't see the distinction."

"Don't tell me. She's weaving human music now."

"Precisely. Comes out really well, too. You should have seen what Gershwin's *Promenade* sold for, and I'll guide you through "Only The Good Dye Young." You'll appreciate the joke. Look out there!"

Reyes barely dodged a crater in the road. They had entered a poorer part of town without her noticing. The streets were rough, turning to muck in places. Building fronts were dingy with grime and age. The clothes on pedestrians were coarser, faded more than even those in the Overlord's household.

While paying attention to where she stepped, Reyes had a troubling thought. "Oswald, the Tutresh still hold this world under Interdiction Major. Doesn't introducing human culture here violate that?"

"No!" Kihoa heads turned. "The Interdict bans introduction of technology,

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not culture. I got this straight from a Philosopher. I was afraid I wouldn't be able to take my recordings along."

"But those are on computers."

"Right, which I've gotta keep concealed. But think about it. If I couldn't introduce human culture, I couldn't be here. I'm human. It's gonna show—and frankly, that's a good thing. We're here."

"Where?" A sprawling brick building lay ahead, well maintained on the outside, but looking weak in spots. Several fenced-in mounds housed burrowing animals that Kihoa used for food, but even those mounds were smaller and less hole-ridden than others she had seen.

Two Kihoa were tending a mound, until one spied Oswald. They rushed to greet him, welcoming him with words Reyes had trouble understanding. It took a second to realize they were speaking like Imsah did.

Oswald turned out his bag, which did have a book inside. "I completed Act One yesterday," he told them. "I can finish the rest in twenty days, maybe twenty-five. I have duties to perform for the other visitors first. Hey!" he called in English. "Come over, meet Jara and Imeh."

Reyes exchanged awkward greetings with them, as a third Kihoa came out of the house. "Is she like us?" she made out the one named Imeh as asking Oswald.

"Uh . . . she was. Most humans are, but she got . . . remedied before coming here." Three voices gabbled in response, soon joined by two more. "No, that's a very long way off for us," he said heavily. "Even if we succeed, a very long way."

Soon a dozen inhabitants of the house were around Oswald, speaking and listening. A few stared at Reyes, mostly at her hair. Perhaps it was the lustrous blackness, or the length almost to the shoulder, both apparent novelties to the short-coated natives.

Reyes let the looks and words flow over her like water past a stone. She needed that indurate exterior to contain her ominous thoughts, the implications of what Oswald was doing.

She sensed Oswald nearby, speaking to her in *RRoduhim*. "Could we return to the manor, please?" she said.

Oswald backed away, then spoke to the Kihoa, telling some lie about local food disagreeing with her. They regretfully dispersed, and Oswald had to hurry as Reyes was already walking away.

"What's the matter?" His countenance darkened. "Does hearing them offend you, too?"

"No. They—they are *intua*, though." Lead people. The name for Kihoa who only heard with relative pitch, who struggled painstakingly to speak or understand their native tongue. Who heard just as well as most humans.

"Yes, and you saw how they live." He stuffed the book back into his bag. "The worst part of town, the scrawniest *ninfa*, and themselves. Ill-fed, ill-clothed, so afflicted even *my* presence brightens their day."

Reyes heard the tone of self-deprecating humor, but the rest was dead earnest. "All that because of their hearing, you're saying?"

"Just about. It isn't exactly institutionalized prejudice. *Edepotua* come by it naturally, by consensus. They make regular society too uncomfortable for *intua*. Some of them tough it out, but most . . . need to belong somewhere. The home gives them that."

"And you don't intend to let that stand."

It wasn't a question, and Oswald didn't take it as one. "Why should I? I'm going to break that mindset." He waved his bag, holding it by the book inside. "The whole mindset that's held them down, more than they imagine."

The frown slowly deepened on Reyes's face. "How will translating operas help?"

"Not the opera. The medium. I've got Kihoa hooked on the novelty of human music, but from now on, I'm not singing them another note. If they want my lat-

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est composition—" He cackled to himself. "—someone will have to buy the book."

Reyes thought hard. "I know books are rare here. That's in the cultural files."

"Do you know why? Because *they* need them." He thumbed over his shoulder, at the distant group home. "Kihoa exchange information orally, because they've got the perfect language to do it. Books are for—they think—the inferior types. Your average Kihoa would no more read a book than you would wear a diaper. It's that humiliating."

He snorted. "The worst thing is, they don't know their pride has cost them. How far back do you think Kihoa history goes?"

Reyes shook her head. "I couldn't guess. Human recorded history is seven, eight thousand years. I'd say lower for Kihoa. Two thousand, three."

"Try seventeen thousand years, Kihoa. In solar years, figure an even twenty thousand. Their oldest historical recitations go back eight hundred generations." He nodded at her surprise. "Uh-huh, you're getting it. Twenty thousand years, and look how far it's gotten them."

Reyes felt her ribcage clench down on her. "Civilization depends on preservation of information," she said, recalling some half-forgotten school lesson. "If they reject a more efficient method of storage, they can't advance past a certain limited rate."

"And they've limited themselves into a perpetual Dark Age here. I've asked around. Inventions and innovations come at glacial paces. It kinda explains—"

"It explains their aversion to new technologies," Reyes concluded. "Swift change is so uncommon here, seeing a spaceship or computer or translator box must be profoundly unsettling, jerking them out of their accustomed tracks. Of course. It fits together."

Oswald's head bobbed jerkily. "So you see why I have to do this?"

"No." The word came unbidden. "Oswald, you can't. The Interdiction—"

"Only covers technological advancement. I'm introducing a social one."

"That's sophistry, Oswald. Besides, manufacturing books is a technology itself."

"Which they have already—and it's not sophistry. It's doing something good for the Kihoa—and why shouldn't I? I belong here now."

Reyes's forbidding glower soon softened into pensiveness. "Are you really doing it for them," she posed, "or for someone particular?"

A look of alarm flared, then dissipated. "I never took you for someone who tried to hit nerves. Learn something bad every day."

"You aren't answering my question."

"No, I'm not." The silence lasted a dozen steps. "Did you ever wonder how Yaru can be Overlord of fourteen towns, yet stay unmarried for fifteen years after his wife died?"

"I hadn't." Partly because she didn't know that many details, partly because it never occurred to her to wonder. "I suppose he loved his wife very much."

"Touching thought." Oswald's voice dropped, though nobody would understand. "Truth is, no woman wants him. They're afraid of bearing another *intua*, like Imsah. Power's supposedly a guarantee of sexual gratification," he said, nose wrinkled, "but here it isn't enough."

Reyes considered. "You think erasing the stigma will improve his personal life. It could destabilize his society, too. He might not want the trade-off."

"Oh, he does. He approves of what I'm doing. He's even helping lay the groundwork, here and there. That's part of the reason he brought Ghiri in."

"He's assisting?" she asked dubiously.

"Not directly. He's more an insurance policy. One more opponent for a challenger to defeat before he can take power. Yaru beat one challenge soon after I came back here, but nothing since."

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They were back in more prosperous parts of town, something Reyes noticed only peripherally. "So Yaru's helping you."

"Hey, before your frown gets any tighter and snaps something, he's not doing it for himself alone."

"Imsah."

"Imsah," Oswald echoed. "If you think Yaru's hard up for a mate, imagine her."

"I assumed—well, I thought that—" How to raise *this?*

"I'm working on Ghiri, on her behalf. Nothing direct: it's way too early. I think I'm convincing him to be her friend, though. Later, when things start changing, it may turn into something more. He could do worse than connect himself to the *Kiahimado* by marriage."

"Oswald!" Her heat surprised her. "How can you do that? Imsah—" Oswald gave her a taut, narrow look that nearly dissuaded her. "She loves you."

A fist clenched, but stayed at his side, shifting in rhythm with his walk. "Yeah. Well, I've gotta be the practical one."

"Her happiness doesn't matter to you?"

Her head jerked back reflexively, saving her nose from a shattering blow. She grabbed and twisted the arm. Oswald raised a leg to kick, but Reyes stared him down. She threw his arm aside, and Oswald lowered his leg. The passersby began moving along again, some hanging back in case tempers reignited.

"I thought you understood," Oswald growled. He stalked away. Reyes followed, waiting for more. Oswald conspicuously ignored his living shadow until within sight of the Overlord's manor.

"She shouldn't suffer for the accident of her birth—or for misplacing her emotions one time. She . . . *o kiagurrah.*"

"She deserves to be loved."

Oswald glanced her way. "'Merits' is a better word. Stronger, less passive. You'll think I'm splitting hairs, but if you knew her . . ."

They were meters from the door. Reyes had to act. "Oswald, this crusade is still misguided. It invites condemnation by the Tutresh, and disruption of Kihoa society. Think: if they're so averse to rapid change, how will they react to your attempt to overthrow this mindset?"

"You're not going to discourage me, Captain ma'am." He stopped right outside the door, under a guard's vigilant watch. "I thought at least, though, you would realize I'm doing good, acting for the right reasons. Won't you say even that?"

"Do you need me to say that? You've never cared about people's opinions before."

Violence flashed in his eyes again. "Fine!" he hissed. He pivoted hard, and carried a thundercloud inside with him.

Reyes watched him recede, wondering at his behavior. She started back toward *Margaret Brent* with an enigma behind, guilty knowledge within, and a decision ahead.

"Captain, you appear perturbed. Was there difficulty with Mister Pitt?"

Reyes rolled her eyes, under the fiction that Margaret was overhead. "Pitt is synonymous with difficulty," she temporized. "Don't read too much into my mood."

"If you insist."

She boarded the lift. "Mess."

"The Tutresh passengers currently occupy the mess. Shall I cancel?"

"All r—no." She went with her impulse. "Take me there."

Margaret did so, in silence Reyes declined to read as reproachful. She stepped out, and nearly jumped as the Legate appeared that same moment.

"Captain, your visitation of the Kihoa community today was questionable."

She stiffened. "Captain's prerogative, Legate."

"Questionable prerogative," it said before she could go further. The Recorder appeared behind him, having difficulty negotiating the doorway. "The Recorder

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desires cooler temperature in our accommodation."

"Ask the computer. She can provide that." She backed away as the Legate advanced, making room for the Recorder's progress.

"Do you desire further speaking, Captain?"

"N-no. Not at this time."

"Then we will pass."

Reyes hugged a bulkhead until they were well beyond her, then slipped into the mess. Tutresh manners could spoil one's mood for conversation fast. She told herself this several times as she prepared dinner, to avoid the other explanation.

"Good evening." Almeyda ambled in, but his bouncy good humor melted away on seeing her. "Something went wrong with Pitt today, didn't it?"

Reyes almost asked if she was wearing a sign, but knew that would draw unwanted attention. "There's wisdom in an old saying," she said, sitting down with her meal, grimacing ruefully. "Be careful what you wish for. You may get it."

Her hopes for another luxuriant nine hours of sleep died a lingering death, strangled in coils of unrelenting thought. She wanted to sit up, dispel some energy that way, but she didn't want Margaret's smothering her further with attention. She lay still, enveloped in misgivings.

Oswald looked to Ghiri as Imsah's future mate. The one instant she saw of them together, Ghiri looked to be no more than tolerating her company. Kihoa body language was different, but not that different—and it wasn't like Oswald to misjudge anybody for the better.

Oswald fooling himself? It didn't seem likely. Reyes opened her eyes to the darkness, and wondered whether she might be the one fooled.

That book in the Tutresh shipment, the one whose diagrams she saw flipping past. Why did they remind her of assembly plans? Why did she think of a printing press? That would be an indisputable violation of the Interdict.

It would also be a lie. Oswald lying to her made little sense, either. He wouldn't lie to improve her opinion of him. He didn't *care* what other people thought.

But he had cared what she thought today, enough to seek her approval.

Every way she turned, a conundrum lay in her path. She couldn't make his actions make sense.

Still, that wasn't her concern. The Tutresh could worry about motivations—or not. They might simply punish.

That assumed that she told them—and no, she wasn't ready for that. Perhaps after tomorrow. After she spoke to Oswald one more time. After she began to understand.

Reyes had duties in the morning, as the Tutresh asked her to prepare the *Brent* for departure that day. They were eager to leave Kuess, and very eager for her to arrange it. She lost several hours to her work, but didn't worry too much. Oswald wouldn't be finished yet.

After a hasty light lunch, she hit the road back into town. The white sun overhead was already hot, and it seemed she was walking in a groove that her previous passages had worn into the packed dirt. She arrived in town wanting a nap, but she wouldn't get that here.

The guard stopped her at the manor door. "The household is eating," he said with finality.

Reyes acquiesced, and waited. Nobody inside would have company while they ate. It wasn't done among Kihoa, save in the case of children—or mates. Oswald hadn't known that the first time he was here, when Imsah began eating with him. She wondered whether she ate by herself now.

Finally, she got inside, and Yaru was waiting for her. "Are you here for Pitt?" He barely gave her time to acknowl-

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edge. "Your quarrel yesterday upset him. He may not wish to see you."

"I must. Overlord . . . Oswald is doing things the Tutresh do not allow. He has included you in these actions. You should know—"

Yaru's hands passed over his ears. "You must learn to arrange your words properly," he said, and withdrew his presence.

Reyes felt herself turn red. She thought she had learned this language—or was he shamming, to avoid awkward questions? Wheels within wheels, dizzying her with their spinning.

She climbed the stairs, and found Oswald's door closed. She rapped. A moment passed, then she heard "Reyes?" as though Oswald were challenging her to admit it.

"It's me. How did—"

Oswald yanked the door open. "You knock like a human. I'm busy, almost done with this lexicon, so don't bother me."

"I won't." She jammed the door before he could close it. "I'll be very quiet. You did invite me to look at Imsah's tapestries, didn't you?"

He glared, then snorted and dropped to the floor, where his computer was. "Close the door. They aren't supposed to see me with this."

By the time she obeyed, he was deep into recitation, unapproachable. She listened to the unfamiliar words and their translations, but her interest soon waned. She wandered over to study the tapestry farthest from Oswald.

The jagged lines and colors baffled her, but she persevered. If it represented music, the widths of lines had to stand for measure, the colors for pitch, the sharpness of angles for timbre—possibly. She tried to match it to the pieces Oswald mentioned yesterday, but it didn't click.

"Guessed it yet?"

She looked at Oswald, standing beside her, sneering faintly. "Not yet."

"Should I let you work on it longer—" He chortled. "—or should I tell you it's patterned after Kihoa speech? Nothing human to it."

Reyes let him finish his laughing spasm. "Didn't you have work, Mister Pitt?"

"I did." Memory bars fanned in his hand. "Work goes fast, once you find a rhythm. You can take these back to the Legate, and I'll see you again in two Tutresh years."

"I'm not here as a courier. I'm here to finish the discussion we started yesterday."

Oswald folded his stack of bars abruptly. "There's nothing more to discuss. You've made your opinion obvious. I'll thank you to get out."

"Then you won't be thanking me."

He glowered. "Oh, I'll make you get out."

She expected a shout for the guards, but instead he muscled past her, out the door. She pursued, not catching up until well outside the manor.

"Told you I'd get you out," he said, and broke into a full run, toward the hills. Reyes went after him, full tilt. She had alterations to fit the environment, but Oswald had long legs. He maintained a dozen-pace lead.

"Oswald!" Reyes gasped. "The Tutresh—won't stand—for this. The least—they'll do—is take—you off—this world—unless they—bury you here!"

"They won't take me! I won't let them!"

Just as Reyes began slipping behind, Oswald fell from a gallop to a canter. She almost ran into him, then saw what had slowed him. Two low shapes were advancing toward them, a kilometer distant.

"Oh, no," she muttered. "Oswald, slow down."

"The faster I give them their lexicon, the faster you'll leave."

They were getting close fast, and Reyes didn't know how sensitive their translator boxes were. "You aren't leaving me much choice," she whispered.

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He looked over, then conspicuously away. "Well, I can always count on you to make the wrong decision."

By the time Reyes untied her tongue, the Tutresh were too close to risk saying anything more. "I've got your language files right here," Oswald told them, flourishing the bars with a vaguely obscene motion.

The Legate stood like a statue, only not as lifelike, for a long moment. "We require our processor as well, ex-Speaker Pitt. Abandoning it here would jeopardize Interdiction unnecessarily. You will retrieve it."

Oswald's jaw briefly swung, then snapped shut. "Fine," he said, and stalked off back toward town.

"Captain," the Legate said, "make final preparation for departure. We leave immediately upon our return."

Reyes took the order with more poise. "Understood."

The two Tutresh went after Pitt, who was still talking to himself in the distance. "Perfect. Perfect!" she heard him shout at one point. She had started back toward the *Brent* before realizing what she had forgotten to do.

She didn't go much further before deciding she could stand to forget permanently.

The Tutresh were back aboard within two hours, and Reyes didn't make them wait. She lifted the ship seconds after sealing up, staying at the helm until the FTL engine kicked in an hour later.

She even called their cabin, direct from her seat at the helm. "We require nothing," the Legate replied to her offer, "except the rudimentary courtesies you have provided throughout this journey. That is all."

Sal Almeyda heard the brief conversation from his post. "They make it awfully hard on a person sometimes," he said sympathetically.

Reyes didn't reply. She had the opposite thought in mind.

* * *

Her first nagging qualm arose the next day, when the Legate walked onto the bridge. He had bars of data to transmit ahead to Tukadesh—data apparently not for the intermedia officer's eyes or ears. Almeyda stepped aside with some grace, and oversaw the operation as much as the Legate allowed.

Reyes suppressed the tug on her conscience. She had a commercial obligation to the Legate. She had not volunteered to perform their law enforcement. That was their job. As for Oswald's meddling, she could give him the benefit of the doubt.

Over the next couple days, she would bring out that 'benefit of the doubt' argument whenever a moment of indecision struck her. The more she used it, the more force it gained. Maybe the Kihoa needed some meddling. If all they had gotten themselves after twenty millennia of civilization was stagnation, squalor, and prejudice, perhaps the pure disruptive force of an Oswald Pitt would be good for them.

It had to be good for somebody.

Four days out from Kuess, she found Radha Natarajan in the cargo hold during a walking inspection of the ship. She had neglected her new officer in days past, and struck up a conversation there to compensate. Radha responded diffidently, and the discourse soon ran down.

As Reyes wondered whether to let it go, she heard a deep breath. "Captain, do you have regulations governing . . . on-board relationships?"

Reyes started. "What?"

"I mean, it can't be forbidden, unless Zheng and Mon were exempted. I just wondered if there's anything that prevents—could prevent—"

"It's Hardy, right?" The look on Natarajan's face said that much. "Radha, *I* will prevent it. If he's coercing you, I will put him off this ship at Tukadesh, if not before. You have rights, and I won't allow—"

Radha was shaking her head. "No.

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Captain, you don't have to prevent anything. I don't want you to."

"It's not an imposition. He's the one imposing on you."

"No he isn't." She was trembling, but holding her ground. "His attentions aren't unwelcome, Captain. Maybe you thought so, but you're wrong."

Reyes's shoulders fell. "Are you certain? I'm giving you an opportunity."

"Captain, do you think I'm incapable of looking after myself?"

Reyes did not answer—because that was the assumption she had made.

"Is it because I'm so small? You assume someone who won't rewrite her genes to "correct" that, or to adapt her body to a new planet, must be weak, fatalistic?"

"That's . . . what I assumed. Fatalism is fairly common in your part of Earth."

Natarajan held something down. It was strange to see her timorousness yielding to vehemence. "My attitude toward gene revision is an article of belief, and honestly not your concern. Is it fatalistic? Perhaps, but foreordainment of my body is one thing. Surrendering myself to somebody else's will is another. I will not do that—not even for you. If that is unacceptable, I will quit the ship at your earliest convenience."

"No. That isn't necessary." Her voice was soft, almost contrite. "If there's no coercion or exploitation, my command interest doesn't extend to . . . ."

She trailed away. Natarajan discreetly left the hold, leaving the captain to contemplate the fallibility of righteous indignation.

Reyes virtually confined herself to her cabin afterward. She played the *Concerto in F* thrice in four days, but it unraveled no farther for her. She dug out her Puccini bar, plugged into Margaret for direct Italian translation, and listened to *La Bohème* straight through. It left her more despondent than before.

She was debating whether to try the *Concerto* again when Margaret announced a visitor. "It's Mister Almeyda, right?" she guessed.

"Correct, Captain. Shall I admit him?"

"May as well." She was as neatly presentable as her room, at least on the outside. Almeyda came inside, as solicitous as she expected. "Please leave us, Margaret," she said.

Almeyda glanced upward. "You expect to say something she shouldn't hear?"

"Not her. The Tutresh. I imagine they have ways of convincing her to talk."

He nodded. "Then what is it the Tutresh shouldn't hear?"

"That's the trouble. I don't know whether they should or not."

She sat him down, and told him everything. The telling drained her, but less of energy than of the putrid humors accumulated within her. She sometimes wanted to withhold the worst, spare him, but she needed the relief too much.

By the time all was out, she had sunk to the edge of the bed near his chair. "I'm trapped between options. Each one keeps pulling at me, and I don't trust my own authority to make the choice. I feel like I'll break."

"You aren't going to break, Noemi. It isn't like you."

"And how well do you know me?" Her casual reproach chagrined him. "I have every good by-the-book reason to report him, and what's my counter-argument? That his taste in music has rubbed off on me?"

"You have other reasons. You told them to me."

"Right." She looked just past him. "Sal, a captain needs to trust her personal judgment to command effectively. What happens if I can't trust my intuition?"

Almeyda caught her eye. "This may sound strange, but I think you do."

She looked away. "What would you do?"

"What I *will* do is back my captain."

She took a long time to look back at

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him. "I'm not going to tell the Tutresh," she said, "but I know I'll be tempted. When I am, I want you there, stopping me."

He smiled wanly. "You can depend on me, Noemi." His hand reached for hers.

"Thanks, Sal. I will." She gave his hand a brief, firm shake, and let go. "Time I made the rounds." She nearly reached the door before looking back. "Will you come along?"

Almeyda's pale smile held. "Certainly, Captain."

The remaining week was a slow release from tension and worry. Each day reduced the lingering chance that the Legate might somehow discover her concealment. That would be worse than whatever punishment they exacted: it would damage her reputation—and her self-respect.

But those fears waned. *Brent* was in good order, and her crew in rising spirits as the departure of the Tutresh neared. Zheng and Mon looked less intense in their interfacings, more mildly content. Whatever was now happening between Nick and Radha, it was very discreet.

Reyes found herself needing less music. Oswald Pitt was receding from prominence in her thoughts, resuming his familiar background presence. Of course, she was in no danger of forgetting him entirely. She probably never would be.

Finally, there came Tukadesh. Reyes took the helm, gently brushing aside Margaret's offer to land the ship. Almeyda called the port from orbit, requisitioning one of the human work teams that resided there to service ships from Earth or its colonies. Their spare cabin needed restoration, and they had no reason to wait.

They landed in the midst of a cool afternoon, despite it being ship's morning. Reyes ordered the cargo hold opened, partly for the work crew's convenience, partly for the Recorder's necessity. Ship's stores had agreed with it too well. It was noticeably fatter at its fringe, the conic slope of its body flattened, and it might not have fit through the crew portal.

She and Almeyda were in the hold for politeness's sake, Radha to prepare the remnants of the old cabin for reassembly, and Zheng perhaps to confirm for the others that the Tutresh were really leaving. That they did, carrying their own luggage for the first and last time.

"Good bye, Legate, Recorder," Reyes said mechanically. "I hope your trip was pleasant." She winced as those words came out.

"It was agreeable," the Legate surprised her by saying, "and informative. We must now depart, Captain. We have duties to perform before you are summoned."

They scuttled through the bay, not marking the confusion they left behind. "Summoned?" Almeyda said. "Did a meeting request come through while I was off duty?"

"Negative," Margaret responded.

"News to me too," said Reyes. "I suppose I'll learn soon—"

Her answer arrived in the berth doorway that moment, wearing the black and white stripes of a Proxy. The Legate and Recorder cringed in its presence, made hard by their burdens, and doubly hard for the overgrown Recorder.

Reyes felt her innards crumple, but the sensation gave way to calm. "Keep things running here, Sal. You're acting captain—maybe not even acting before long."

She strode out of the hold, meeting the Proxy on its own ground. "I will take your path, Proxy," she said before it could make its usual speech. The Proxy hesitated, rotated a bit, then began leading Captain Reyes to her fate.

The Philosophers' Tower was as ugly as Reyes remembered, all metal, no windows or color variations, adamantine and aloof. Humans thought of Tutresh

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much the same way, and the Tutresh usually worked to intensify the impression.

The Proxy led her inside, through the dazzling mirrors of the Reflection Room, and into a lift. Reyes ducked, but she had a good two decimeters above her head. The car rose fast, almost buckling her knees at first.

She hadn't spoken a word since leaving *Brent*'s berth. She wouldn't weaken herself before the Proxy by asking where she was bound—and what else was there to say?

The lift opened, and light flooded in. "Proceed," the Proxy said, its first word. She did, but the Proxy remained inside. The shutting door nearly clipped her shoulder blades.

She was on a gantry, leading to a platform in the center of the room. The floor lay ten meters below; the ceiling ten meters above. They and all the walls were silvered, reflecting the light blazing from the eight corners of the room.

So this was a Judgment Chamber. Descriptions didn't capture its overall effect. How could they?

Reyes walked to the central platform. When she stepped upon it, the lights changed. In the corners, white ceramite balconies emerged from the brilliance. Tutresh advanced, wearing white robes with small black starburst patterns, filling all but one space. What background noise there had been in the room abruptly ceased. The silence gripped her more tightly than all her fears.

A wave of pops and hisses came from a Tutresh ahead, below, and to Reyes's left. "We shall review the evidence for our witness," a translator voice said. The Tutresh moved a forward arm. Tutresh speech crackled in the background, but that was translation of the human voices Reyes heard: Oswald's—and hers.

She recognized the conversation, from the last time she had been in Oswald's room. It went beyond that, however, to their chase past the Kihoa farmlands, and the arrival of the Tutresh. The voices then stopped.

"Noemi Reyes, Captain." This voice was below, behind, and right. "You said to Oswald Pitt, ex-Speaker—"

Her voice played again, gasping: "*The Tutresh won't stand for this. The least they'll do is take you off this world, unless they bury you here.*"

"What act did the ex-Speaker commit that would cause these things?"

They had her. She briefly thought of escape, but she knew the lift wouldn't receive her. Even as that thought passed, the last balcony received its occupant, completing the array. This one wore gray, with a pattern she couldn't make out—but it was inordinately fat.

"Captain, make a reply."

How did it record them? Something in the computer? Impossible: he left it behind. In the memory bars themselves? She couldn't see how—but Tutresh had ways.

Tutresh shuffled in place. Reyes knew she had to answer them, and knew lies would not abide here. "Oswald wishes to break the Kihoa stigma against books, and against those who cannot discern absolute pitch."

Clicks and snaps rebounded off the walls, sounding like a cloud of locusts. Reyes heard translations, but couldn't untangle them before they stopped speaking.

"You knew this," Below-behind-right said, "and did not inform your Tutresh passengers. We will know why."

Her last hope guttered and died. "I assume he is violating your Interdiction."

"Correct. Why did you not notify the Legate and Recorder? Were you protecting your Earth's relations with Tukadesh?"

Another voice spoke, above-ahead-right. "Did you believe you had no duty to assist?"

And another. "Did you seek to shield the ex-Speaker from accounting for his action?"

Reyes was losing track of who spoke.

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"Do you value this individual over your ship's collective good?"

"Over your race's collective good?"

"Did you judge the actions beneficial to the Kihoa?"

"Did you approve of the violation?"

"Were you uncertain that Interdiction Major Modified barred the ex-Speaker's actions?"

Silence followed the last question. Reyes was dizzy, but thought she knew where it came from. She looked over her left shoulder. She couldn't make out the pattern on its white robe, and wondered whether there was any.

The Judgment Chamber hung on its words. "Evidence supports this conclusion. Attend."

Again, she heard her voice. "*You aren't leaving me much choice.*"

And Pitt's. "*Well, I can always count on you to make the wrong decision.*"

"The ex-Speaker challenged your conclusion," the white Tutresh said. "You would not have opened the subject if you had not wanted to effect change. Therefore, you wanted to stop his actions, but he compelled you to reconsider. Do you confirm this, Captain?"

She swallowed. They were offering her a way out—but it was too easy. "I did have doubts about the extent of the Interdiction," she allowed. "Pitt touched on them, but I—"

"Enough. You are a Captain, a leader of humans. We will respect that, and will not compel you to admit your indecision or misjudgment."

Reyes felt another prideful twinge, but could not act upon it. "This body absolves you of complicity in the violation of Interdiction Major Modified. As demonstration of our trust, we offer your vessel a new commission, to transport seed-stock to our colony on Kitrapash. Particulars of this offer will be transmitted to your ship presently. You are discharged, Captain."

The lift door whooshed open behind her. "Wait," Reyes said. "What will happen to Pitt?"

The white Tutresh moved toward the rim of its balcony. "How does the ex-Speaker's correction concern you?"

She faced their leader squarely. "He was once a subordinate of mine."

Chatter hummed in the background. "An adequate motive. We shall remove him from Kuess back to Tukadesh, where he will undergo our Judgment. Once he is removed, Kuess will fall under Interdiction Absolute. The specific end of the ex-Speaker, we cannot now say. You are discharged."

Reyes opened her mouth—but what more could she say?

The haze around Reyes didn't part until she was outside, dodging Tutresh on the street. Her brush with Tutresh justice had scathed her far less than she could have expected—and less than she deserved.

Well, what would sacrificing herself have done? Penalized her crew, yes. Helped Oswald, no. He would have to face the consequences of his actions. Whatever happened, he had brought it upon himself.

The pale sun dimmed behind filmy clouds. What would that punishment be? There were many rumors about Tutresh justice, and very few facts. All she knew was that they would take him from Kuess, from the society he chose—and the one being in the universe who loved him.

Workers were in *Brent*'s cargo bay, carrying materials into the ship to refit their cabin. Reyes could feel the noises of disassembly through her soles. She greeted them perfunctorily in passing, heading to the bridge.

"Captain, Margaret says you're back." It was Sal, on the intercall. "We got a message from the Tutresh—"

"Our new assignment. I know. Call up Alien Interface."

"The Commercial section, I assume."

"Negative. Diplomatic."

Sal had the channel ready when Reyes arrived on the bridge. "What's this about?"

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Reyes didn't answer him. "Interface, this is Captain Reyes of the *Margaret Brent*. Your Philosophers have passed judgment on a human living on Kuess, and are preparing to remove him from that world. Do you confirm this knowledge?"

A moment passed. "Judgment is confirmed," came the translated reply.

"This ship offers to remove the human, to return him to human society, and spare the Tutresh the inconvenience of tending for an alien."

Sal leaned in. "What are you doing?" he whispered.

"They're removing Oswald. I'm trying to spare him—humans doing it will cushion—"

"The offer is rejected. The Tutresh will administer justice."

"I—I understand. Can we at least convey him to Tukadesh ourselves?"

"The Tutresh will administer justice." The connection cut.

Reyes backed slowly away from Sal's intermedia board, groping for her chair at helm. She sat with her hand at her chin, covering her mouth. Sal stood by, straining yet patient.

Reyes spun her chair toward the controls. "Margaret, announce to the crew there will be an emergency meeting in the cargo hold in ten minutes. Sal, I need you to call the stockhouse. Get us provisioned for five weeks, immediately. I'll get us fueled. We have the money—or we should."

She checked the financial log. Sure enough, the Tutresh had made payment for their passenger run. It was quite a number. It would solve lots of problems—or one.

"Get going, Mister," she told a hesitant Almeyda. "We don't have all day."

"Why, Captain?" Nick Hardy nearly bellowed. "What does this get us?"

"It doesn't get you anything." She directed that to the whole crew: two couples, and Almeyda standing alone. "Neither will it cost you anything. You'll draw your salaries as though this were a paying mission. I'm the only one running a risk."

"Oh, right." Hardy was inching forward. "We're supposed to believe flying in the face of the Tutresh doesn't put us at risk."

"It doesn't, Hardy. Tutresh believe in rigid hierarchical structures. You won't be punished for obeying my commands. If anyone suffers, it'll be me."

"And what about our business deal?" Kayah Mon asked. "How will that survive?"

Reyes grimaced. "I'm guessing it won't. Fortunately, the Tutresh aren't the only customers in space—and honestly, I'm tired of dealing with them."

"Captain." Zheng's calm tone stood in sharp relief against the tension in the hold. "I accept your command prerogatives, and don't dispute severing ties with the Tutresh—but for Oswald Pitt?" Three more voices rose in agreement.

Reyes waited for relative quiet. "I don't expect you to comprehend all my reasons, but think of this one. Judging by what you know, or think, of Tutresh justice, is there any human being you'd want to fall into their power?"

Four mouths twitched, all wanting to say "Oswald," but none wanting to be first. Reyes capitalized on their hesitation.

"I thought not. Zheng, Mon, get working on increasing our FTL speed. I don't want the Tutresh beating us there. Natarajan, make sure our fuel and supplies get loaded without delay. Hardy, tell the work crews to finish in three hours, even if there's work left undone. They'll get paid for however long they would have worked, but don't tell them yet. Let's go."

The spur of duty moved them before indecision could take hold. Reyes got moving herself. She had her own work.

Brent was ready to fly in three hours. Almeyda saved his launch clearance request to the last moment, so the various

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Tutresh compartments wouldn't have time to share knowledge and deduce what was happening.

"If they delay us—" Almeyda began to say, before his board flashed. He heaved a sigh. "Clear for departure, Captain."

"Right. Margaret, pipe me to all decks. Attention," she said, her voice reverberating from the shipwide broadcast, "secure for immediate launch. We are going up . . . now!"

Liftoff pushed Reyes against her chair, their acceleration imperfectly negated by inertial compensators. The stress lasted much longer than usual, as she pressed the ship for speed. Minutes counted now; they would have two weeks to recover from their aches.

The weight finally lifted, as standard gravity returned. Reyes had Margaret's course calculations on her board when Almeyda's board flashed.

"*Margaret Brent*, you have departed without your cargo. You will explain."

Reyes pointed at her console, and Almeyda passed her intermedia control. "Commercial Interface, no contract was agreed upon. We have declined to carry this cargo."

She hit a button. "Zheng, can we go FTL this moment?"

"Affirmative."

"Captain," Margaret said, "we won't have a vector for Kuess for eleven minutes."

"But it will get us away. We can decelerate and alter vector later."

A new artificial voice burst over the speaker. "Human vessel *Margaret Brent*, flight clearance is withdrawn. Halt all acceleration and awai*iti*—"

The voice fell away, as the condensate engine kicked in. Reyes's eyes sagged shut. "So far, so good," she said hollowly. "They'll try by tachyon pulse next, Sal. Monitor, but don't respond."

"Aye aye. Any other orders?"

"Nothing, except—help me hold this ship together."

That task wasn't easy. The engineers raised their cruising speed some percentage points, at the cost of constant vigilance. When Zheng was asleep, Mon had to nursemaid the condensate flow; when Mon slept, Zheng worked. Their tempers began to fray, even when linked.

Reyes naturally left them out of the reconstruction project. Everyone else had to help pick up where the restoration of the Tutresh's cabin had been left off. Work was slow for inexperienced hands, but Margaret's assistance helped them avoid mistakes.

The reconstruction was something to prevent idleness, that breeding ground of resentment. With Hardy and Natarajan, it succeeded halfway. Fortunately, they could turn toward each other for support. Reyes wasn't accustomed to being thankful for on-board relationships, but she learned.

She had her own cure for idleness, renewed language instruction. Margaret was soon praising her progress, and Margaret wasn't likely to lie for ego's sake.

Almeyda kept their channels open, listening for news about themselves. After a flurry of traffic following their departure, though, he could pick up nothing.

"We're out of the main transmission lanes," he explained to Captain Reyes in her quarters. "I can't catch anything useful. I'm sorry."

"It's all right." She began pacing, but stopped herself. With Kuess two days away, she had different causes for nerves. "You aren't a miracle worker, Sal."

Almeyda read her expression. "Was my predecessor?"

"Well—maybe not *that* good."

His carriage stiffened. "When we do retrieve him—" He had learned to say 'when'. "—do you have plans for him? Professional plans?"

Reyes arched her eyebrows. "Are you worried for your job?"

Almeyda took time marshaling his thoughts. "From all I've heard, he is a

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better intermedia officer. As for an executive officer, Zheng has the experience, the demeanor."

"Sal, are you trying to talk yourself out of your position?"

He grimaced. "I'm pointing out facts, regardless of how they reflect on me."

"Then let me point this out. Zheng wouldn't have stood by me when I announced this mission. He would have raised his objections before everyone, and that would have destroyed my ability to command."

She advanced within inches of Almeyda's face, not threatening, but insistent. "You have your reservations—you've told them to me, though even now I think you're holding back—but you saved them for private moments. That's loyalty; better, that's discipline. It's what I need in a first mate, more than ever. So don't treat yourself as dispensable. You're not."

Almeyda gulped, but held Reyes's eye. "I'm—glad to hear you say so, Noemi—I mean, Captain." He backed away slowly. "I'm going to give the receiver another try. Who knows? I might have a miracle in me after all."

Reyes watched him go, half-wanting to follow. Did she have another enigma on her hands? One had been quite enough.

This time, they descended into dusk. Reyes looked down upon Yaru's capital in the gathering dark, and wondered at the sparks of light she saw in its streets. She thought the Kihoa were too primitive to use artificial light so extensively. Maybe she didn't know them well enough.

Now she wouldn't get the chance.

They settled into the same vale as before. Natarajan had lampglobes ready, placed in translucent baskets and wrapped with fabric to conceal their technology. "Well done," Reyes told her, inspecting them in the cargo bay. "I was worried we'd lose the whole night."

"Anything to finish this quickly, Captain."

She had picked up some of Hardy's more caustic edge. Reyes let it pass. "I'll only need one," she said, hoisting her choice. "No sense in violating the Interdiction any more than necessary." She caught sight of the face Natarajan made. "I'll try to be back quickly, but knowing Oswald, that might—do you hear that?"

The hull rang faintly again. "There is someone striking the hull," Margaret said.

"Any idea who?" Reyes began walking toward the corridor, and the crew portal.

"Yes. Mister Pitt."

Reyes almost stopped, then broke into a dash. "Let him in." The portal opened ahead of her, and she collided with him at the threshold.

"You!" He looked disheveled, even for him, and not all from surprise. "What are you doing here? And what are you waiting for? There's still a chance. Hurry!"

"What? Wait!" She grabbed his wrist, and almost dislocated her shoulder holding him in place. "Oswald, we have to take you away."

"Ghiri pulled a coup, but it might still fail." He pointed her back inside. "Bring the others, maybe a few guns for a display of force."

"Oswald!" She jerked him hard. "The Tutresh are coming for you. You violated the Interdict, and they found out. We came to get you before they do."

"They—" His face turned to thunder. "You told them!"

"I did not! They had a listening device." She felt the presence of people behind her, but couldn't spare her attention. "They're coming to apprehend you, Oswald, send you to Judgment. We're here to help you, but we don't have time to argue."

Oswald went almost limp, eyes glazing. Reyes sympathetically softened her grip—and Oswald tore loose. "No, not this way. You have to stop Ghiri. I'll make you stop him!"

"No!" Reyes grabbed for him, but he

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was already through the hatch, running in the direction of town.

She picked herself up, to face the whole crew behind her. "I'm going after him. Sal, Nick, get lamps from Radha—and arms from the locker, and follow me." Without waiting for replies, she sprinted through the portal, into the dying twilight.

She made out Oswald's silhouette ahead, but just as soon another appeared with it. She heard him exclaim in *RRoduhim*, "How did you get away, Imsah?"

"I saw the disturbance around the house, before they saw me. I—" Imsah started at Reyes's appearance. "I knew what had happened."

"What did?" Reyes asked.

Imsah looked toward her distant home. "Ghiri took the town, while my father was away, visiting another community."

"Backstabber," Oswald growled in English. "Coward!"

"Wait. Imsah, doesn't Ghiri have to formally challenge your father?"

"If he follows forms—but he won't. He was too angry when he first learned." She turned to Oswald. "I went to find you, to warn you. You must have known too, though."

Oswald rested a hand on her shoulder, nodding gently. Before Reyes could bear to interrupt him, he did it himself. "Captain, for her sake, we've got to stop him."

Reyes almost answered, then switched langauges to shield Imsah. "No. The Tutresh could be here any minute. Things were bad enough before this happened."

"You can't take me!" he shouted in *RRoduhim*, making sure Imsah understood. "You're betraying Yaru, abandoning her! You have to stop them!"

He bolted again. Reyes lunged, caught his ankle, and brought him down. He twisted and twisted, and she felt her hold slipping. Then footsteps pounded past her. She thought of Imsah, before seeing uniform boots, and who filled them.

Almeyda and Hardy hoisted Oswald with one hand each, toting hefty guns with their other hands. Oswald still writhed, helplessly. "Orders, Captain?" said Almeyda.

Reyes stood dizzily. Her eyes wouldn't focus for a second, but when they did, it was on something beyond them. There were distant lights on the road, dancing around a steady rhythm, and closing.

Kihoa. The word stood for their race, or with the notes changed, for the word "mob."

"Take him inside," she rasped. Oswald screamed at her as they dragged him away, but she already knew what he was saying. "Imsah . . ."

"Let me go with him."

There it was. "Imsah . . . he's going to human worlds. He won't return."

Imsah looked behind her, at the lights growing nearer, and beyond. Reyes knew who she was thinking of. She turned back, downcast but looking squarely ahead. "Then I won't return."

Reyes hesitated. Another step deeper . . . but what was the alternative? "Inside. Hurry," she said, so the mob and her doubts would not catch them.

Departure was swift, without a sign of Tutresh before they leaped to FTL. The nineteen days looming ahead before reaching Earth promised anything but swiftness.

Imsah came aboard with the clothes on her back, and a lifetime of primitive conditions in her past. Each opening door was a shock, figuratively and literally. She needed a guide to the new world she had entered, and fortunately she had one—but not the one she expected.

Oswald found the empty cabin, and locked himself inside before anyone could stop him. Once it was obvious he wasn't coming out, Reyes told Margaret to cut off the intricate slanders he broadcast from there. Only in an emer-

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gency would anything he said get through.

Reyes struggled with what to tell Imsah, but it proved unnecessary. Astonishment with their ship had swept her away. When Reyes did begin to broach it, Imsah looked distantly resigned, as though familiar with such spells.

The captain brought Imsah to her quarters, showing her how everything in the bathroom worked, then leaving her to do whatever she needed. When she came back, with pillows borrowed from the crew, Imsah was still inside, chatting away in *RRodubim* with Margaret. The shock of a speaking computer had dissipated, but the novelty hadn't.

Reyes insisted on taking the floor that night, leaving Imsah her bed, decadently wide and soft compared to her accustomed furnishings. She deserved that much comfort.

Reyes became her escort through their corner of the modern human world. She introduced her to all the crewmembers, whom she had told to make Imsah welcome, or else; steered her through getting meals in the mess, apologizing for the unpalatable selection; prepared her all she could for what Earth would be like.

She drew Imsah out enough to fill in details of that night. Oswald had released *La Bohème* to the Kihoa as a book, as promised. Ghiri took it as a humiliating insult, and used Yaru's apparent complicity as grounds to rebel against him. Oswald's fate would have been swift and final. When it came to hers, or her father's, Imsah stopped cold and would speak no more.

Imsah kept her own counsel after that, speaking mostly with Margaret. She fought being overwhelmed by maintaining distance. She was reticent in speech and action, indisposed to risk the myriad invisible pitfalls awaiting her in a magical culture she had barely started to understand. For all that, she comported herself very solidly.

She probably did not notice her own lapses: the shudders that sometimes coursed through her; the brief glimpses of helplessness; the tiny, clotted whimpers that escaped her as she lay in bed. Reyes witnessed them all, wishing she could break the enormous isolation, but dared not endanger her fractured composure again by bringing up the Kihoa, or Yaru—or Oswald.

Her own composure was not in its best shape. Almeyda finally began picking up tachyon traffic. The Tutresh had waited to contact Earth until they arrived at Kuess and found Oswald gone. Now the invective flew. "No sense of collective good" was the kindest tarring they gave the human race; immediate extradition of Oswald and Reyes their mildest demands.

Almeyda reported developments with a brave face, but Reyes saw the worry creeping into his fine wrinkles, and under his eyes. "We could make planetfall somewhere else," he suggested at one point.

"No. No ducking this time. We're going to Earth, and we're telling them to expect us." She lifted a computer pad. "I have my message worked out. It explains our side, and it puts full responsibility on me. The Tutresh may accept that, even if Earth doesn't."

"You won't even defend yourself?"

Her mouth quirked. "Of course I'm defending myself. I just don't have any illusions about success." She handed him the pad. "Send that to Earth and Tukadesh."

Almeyda got to work, while Reyes leaned over her helm console. That was her contribution toward solving one problem. Now to start budging the next.

He sat on the floor, weak light keeping him from fading completely into the darkness. He rocked slowly, rhythmically, to sounds that didn't reach the air. It was as though he didn't exist, or the rest of the universe didn't.

Outside glare abruptly poured

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through an open door, outlining a figure with its arms full. He yelped, averting his eyes. "Get out!" he shouted, but it came out as a hollow croak. "Margaret, you liar, you said the door was locked!"

"It was," the interloper said, "but I overrode it. Safety protocols." She entered. "I asked her to tell me when you snuck out to the mess. Two days later, I decided I'd made the wrong assumption. Margaret tells me you haven't left this room in almost five days."

"Five? Fine, five. So what?"

"So you haven't eaten in five days. That's where the safety override comes in." Captain Reyes knelt before Oswald, setting the trays at his crossed legs. Her nose scrunched involuntarily on coming close to him.

Oswald snorted, and looked away. His eye didn't wander back for a minute, but when it did, it kept coming back. Reyes showed no reaction to his irresolution.

Finally, a hand snatched something from one plate. He opened his mouth, then shut it with a glare at Reyes.

"I'll step into the bathroom while you eat."

"No," he said, halting her. He replaced the morsel and shoved the trays away. "Talking with you will ruin my appetite. That's why you're really here, not to feed me. You're always one for talking. So let's get it over with."

"Fine." She stood along the bulkhead, looming over him. "I know how much you resent me for taking you away."

"You figured that out? From those tiny little clues I broadcast all over the ship? No wonder you're a captain."

"Just consider what awaited you with the Tutresh."

"At least I'd have my music files while awaiting it. Guess the Tutresh have them now."

Her face pinched momentarily, an eloquent confirmation. "I'll lend you mine."

"I don't want anything from you." His retort was a reflex, drained of energy and brass. Only the words sounded like him.

"OK, if you don't want anything, let's talk about what someone else wants, or needs."

"Oh, here it comes."

"That's right, here it comes!" She strode forward, looking straight down on his head. "Imsah gave up everything to follow you, and how have you repaid her?"

"You shouldn't have brought her aboard," he riposted. "The Tutresh are liable to eat you alive, and you better hope that's figurative."

"Don't change the subject, Oswald. It shows you have something to hide."

Oswald untangled his legs and stood, his emaciated frame ranging nearly a head over her. Reyes almost recoiled, but stood fast.

"She hasn't seen you in five days. Doesn't someone who loves you deserve better?"

"Let me ask the real question. Why did you yank her away from the only home she's ever had? I know Kihoa culture. Her father would probably have lived, however the coup turned out. Why did you take her from the only person who loves her?"

"Because it was too risky for her to stay . . . and because she asked . . . and because Yaru isn't the only person who loves her."

He hawked sourly. "Nice try, but wrong again. I don't love her."

Reyes faced him squarely, calmly. "Of course you do."

His face hardened, almost into a skull. "Like you would know."

"Like I could miss it. They way you speak about her, praise her, defend her, help her." Oswald stalked into a corner. She didn't pursue.

"Your whole scheme to break the stigma against *intua*, against books. That wasn't for the Kihoa race, or those poor ghetto dwellers. It was about her. You wanted to make her life easier, happier. You wanted her to have a man, a family, like any normal Kihoa woman."

"Yeah," he said, an edge of defiance

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returning. "I wanted to marry her off to Ghiri, idiot that I was. Explain that, if I'm so infatuated with Imsah."

"Simple. It was the most effective way of denying the truth to yourself."

He bared his teeth. "So how do I go about proving you wrong? Declare undying love?"

"You can't prove an untruth, so stop trying."

He barked out a shout, and almost clawed one of the walls. "What is it with humans, wanting to find sex in everything? I thought *you* were smarter than that."

She declined to answer. "You're evading my first point. What are you going to do about Imsah? Leave her to her own devices?"

"Of course not!" His answer was a shriek. "I can't!" He subsided upon himself. "Don't you think I know that?" he said, rasping, almost pleading. He fell against the bulkhead. Reyes carefully approached.

"The poor thing wouldn't be in this mess if she weren't following me. Of course I'm responsible for her. She made a commitment, and now I have to keep it—and I will. I do my duty, Reyes. You can't deny it."

"No. No, I can't take that away from you."

He looked up sharply. She wore a faint grin, a shadow of the Gershwin lyric she had recalled for the occasion. "You pick bizarre times to make jokes, lady."

"The last seven weeks have been bizarre. I was due." She set her grin aside. "So you have this duty toward Imsah, but you lock her out. Why?"

"I lock everyone out—everyone who can't convince the computer to let them inside."

"I'm one thing. She's another. Why won't you see her?"

"I will. I have to, eventually—but you know what she'll expect. You don't commit yourself that strongly to someone and not expect it." His head lay against the bulkhead. "That's your mistake. You think she needs a friend. Maybe, but what she wants . . . ."

There it was. No wonder when she said "love," he heard "sex."

"Oswald, you don't know what she wants."

His eyes slid toward her. "You think I can't tell?"

"I think you've avoided finding out. I think you wouldn't dare touch this subject with her. Assumption suits you better than certainty. It gives you distance you might not have if you learned what she wants."

"Yeah, that's me. Distant all over, and I like that."

"Well, you could have it before, but not now. You admit that much. You can either leave her distant, or find out what closeness will mean." She moved away a step, giving him space. "Imsah's a person, not a force of nature."

"Oh, don't give me the standard sentient rights lecture. I treated her better than anyone."

"What I was saying, Oswald, is that you aren't obligated to give in to her first impulse. She's a thinking entity, and whatever her desires may start out being, she could change her mind." She moved close to the door. "And so could you, though that might sound like a theoretical exercise."

His eyes latched onto her, glassy and sullen, yielding nothing. "Is this where you bring Imsah in, and force the dramatic confrontation?"

She smirked despite herself. "No. This is where I leave you to wrestle with your conscience. Much more effective, I think." On that, she left.

Oswald stayed huddled against the bulkhead, staring down the tray for a long time. The tray finally won. His first bites were slashing and ravenous, but he soon slowed. He needed time to digest everything.

"Has it worked?"

"I don't know, Sal." They were walk-

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ing back from a check of Engineering. "I haven't pressed Imsah for information yet. Perhaps I'll have to."

"Why not press Margaret? She'll know."

"I—that's prying. I couldn't."

"I understand." They boarded the lift together, and it began rising. "Margaret, where's Imsah?"

"Sal!"

"Imsah has gone to Mister Pitt's cabin," said Margaret, ignoring Reyes's objection.

Almeyda grinned. "Well, what do you know?"

"Sal—" The lift opened. She led him into her quarters, a finger raised to her lips. "Don't breathe a word of this to the crew. Same for you, Margaret. The situation's delicate enough without having somebody's prying upsetting everything. Understood?"

"Understood, Captain," Margaret said.

Almeyda's cheeks darkened. "Understood. I apologize."

Reyes softened. "I just know how Oswald would react to being luridly spied upon." She went to her computer console. "Let me see those latest intercepts of yours."

She pored through the tachyon logs, her face turning steely, her body stony. "It's getting too quiet out there. No response from Bern about the Tutresh's demands?"

"Nothing uncoded," Almeyda answered, moving a half-step closer. "No response to us, either."

"No, I don't suppose they'd tell us they intend to confiscate this ship while we can still do something about it." A hand propped up her head. "Maybe selling it first would keep this crew together, at least. What do you say, Sal? Want to buy a used freighter?"

"If you're serious, yes."

She made a crooked smile. "I'm not. No easy answers this time. I'll just make sure it comes down on me alone."

"Noemi, please." Sal made no effort to cover the pain. "Stop taking this posture all the time, that you have to be untouchable and alone. You don't. You aren't. I don't want you to be."

Reyes viewed him askance. "Sal, you're not . . ." But the tired longing she saw confirmed it. She sat quietly for a long time. "Sal, it's not appropri—"

"Don't say that. You aren't coercing me. You would never do that."

"Besides that consideration, it's bad for chain of command. Temporary arrangements always lead to permanent problems."

"Who said anything about being temporary?" Watching Reyes's face relieved some of the ache in his. "We've lived in close quarters for over a year, and gotten along very well. I think we're compatible for marriage, and marriage is compatible for our job. It works for Zheng and Mon."

"They don't have command worries. OK, Zheng is chief engineer, but—wait a minute. When were they married?"

"Three years ago." His eyebrows arched. "You mean you never knew? Well, maybe you wouldn't. You make a point of not asking."

He waited for more, but Reyes had turned inward. He walked toward the door with a contained sigh, but a word from her stopped him short.

"Sal. You may think this is a good time, but it's really the worst. I'm dealing with impending ruination, and trying to contain the damage. That's no time to pretend to be happy, because that's all I'd be doing. I don't want to discuss this now."

Sal looked at the deck. "Yes, Noemi. Yes, Captain."

He reached the door before she spoke again. "But Sal—I will want to discuss this later." He just managed a nod, and left.

Reyes slumped, arms laid across her lap, shaking her head. "He can't be serious. He cannot be serious."

"Are you asking my opinion?"

She picked up her head. "Don't intrude on his privacy."

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"I needn't use such evidence. His physiological responses in your presence have plainly shown physical and emotional attraction for some months."

Reyes's eyes grew. "You knew this that long, and you said nothing?"

"I can keep my physiological evaluations to myself, Captain. Did I ever inform you of the sexes of your Tutresh passengers, that the Recorder was pregnant, and that the Legate was biochemically bound to serve and protect her?"

"No, but you have now. What does that say for your discretion?"

Margaret's voice turned taut. "They treated us like domesticated beasts. Stuff them."

Reyes gulped down a laugh. "Margaret, I think Hardy's a bad influence on you."

She got up and began pacing. "So . . . Sal really is in love with me." Reyes didn't want to think of the consequences, but she knew enough to face the matter, sooner or later. If she could give Oswald that advice, she could take it herself.

Her pacing stopped. How far did that parallel extend? After a moment, she started moving again. "Me, love Sal?" she kidded herself.

Margaret spoke squarely, calmly. "Of course you do."

Nothing aboard her ship ever surprised Reyes. She was too meticulous and professional for that. Imsah's announcement a couple days later, however, did take her unaware.

"I'm going to move out of your room," Imsah told the captain. "Is this all right?"

"All right? Certainly, Imsah, except . . . you have somewhere else to go, right?"

The hair at Imsah's neck fluffed, going along with a purr that in humans would be laughter. "Oswald's room. He thought I should not impose on your hospitality any longer."

"You aren't—never mind. I'm glad you've—er . . ."

Imsah went into the corner. "Could I take these with me?" she asked, pointing at the pillows.

The sound of a shattering assumption jolted her. "Certainly. I don't see why not." She did a second later—they weren't hers to start with—but she couldn't bring herself to take them from Imsah's hands.

Imsah approached with a double armful. "I want to thank you for everything you've done for me, Captain."

"You can still call me Noemi, and the pleasure was mine."

Imsah dipped her head. On her way out, she said, "You will be glad to have your big bed again, won't you?"

"I will." A glimpse of Imsah's expression just as she left made her wonder exactly what she meant. Or perhaps she was imagining things—or projecting them.

No, don't think about such things. Certainly not now.

Nights were increasingly restless. Reyes's sleep grew more fragmented; the incidents of jolting awake, clammy with sweat, mounted. One more occurrence seemed much like the others, until she tried falling back to sleep.

"Repeat, Captain, incoming message. Please remain awake."

She hoisted herself up again, reeling. "All right." She felt her way to the console, her sleepwear clutching and clinging at her. "Put it on here."

A familiar Kron face confronted her. "Captain Reyes, Va calls. Understand your special dealings with Tutresh are void. Wish to negotiate business arrangement."

Reyes needed a second to comprehend. "I desire business, Va, but my future ability to conduct it is most uncertain."

"Your Tutresh deal is broken. Your political difficulties are resolved. Do you reject my offer?"

"No. I accept your offer, but—" What did he know that she didn't? "How were they resolved, Va?"

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"Distrust for Tutresh surfaced. Factions shifted. Consensus formed. Humans take time, but do make sensible decisions."

She absorbed that blankly. "Send me your bid, Va. I will have a decision when we land on Earth."

Va snapped his tongue. "You bargain stiffly. Done."

The room fell back into darkness. Reyes shuffled back to bed, lying on the covers. Did that exchange mean what it seemed to? Were they safe?

"Captain, another call is coming in. A Deputy Drury."

More information . . . but what she had satisfied her. "Take a message," she mumbled, as the sweetest sleep she could remember enfolded her.

The berth was calm. Spaceport security kept reporters and eyebots away. *Brent*'s passengers and crew would have a sporting chance to slip away unnoticed, or remain in peace.

Reyes had the hold open, so crews could remove the detritus of the Tutresh's refitted cabin. She didn't expect anything coming in for a couple days. The Kron offer was a good one, but she could make them wait.

Voices approached, and she busied herself with the financial readouts on a pad. Radha entered, extolling the virtues of some South Indian sights to Nick. A peek showed him taking the lecture with forced patience. Any display that reduced him to silence was formidable indeed.

Radha interrupted herself. "Captain, you needn't be here. I can handle the crews—"

"Nonsense. You're officially on leave, seventy-two hours guaranteed. Don't waste any of it here."

Neither one argued the point. Reyes got back to her pad as they left.

The Tutresh payment had been impressive. So were the food and fuel costs for their rescue mission, not to mention her loan payments in the intervening weeks. As nearly as she could figure, she had stayed fiscally even for the round trip. Apt enough.

Zheng and Mon appeared, hands clasped, engrossed in conversation they alone could experience. "I put in an order for a spare condensing chamber," Zheng told Reyes.

"Anything serious?"

"Just odd fluctuations," said Mon, "maybe picked up from our overdriving. It's precautionary, but best be safe."

Reyes nodded, and they moved along. She made a new entry onto the pad. "So much for breaking even," she breathed.

Doing right had seemed adequate payment, but it gave few comforts. Oswald had stayed hidden away, refusing to be seen. Reyes saw Imsah enough, but she said so little of her relations with Oswald, her silence was plainly at his behest.

Reyes began whistling, not recognizing the theme from the *Concerto in F* until she had meandered beyond it. The concerto, the man: both still eluded her comprehension, yet both still demanded her attention.

She caught the footsteps behind her. "I think our passengers are ready to depart," Sal said.

"Not that either had much packing," she noted. "I made contingency arrangements for Imsah, with people I know at the Aamahh embassy. They'll board her for the cultural contact alone, but as for permanent—"

"Noemi," he interrupted gently, "I think they've made their own arrangements."

Before Reyes could ask, she heard them nearing. They spoke in Kihoa, casually, as though they arrived on Earth twice monthly. As they entered the hold, some comment of Oswald's made both of them laugh.

"Imsah," Reyes called. Imsah went to her, while Oswald went to lean on a bulkhead. "I was going to help you establish yourself, but—" She glanced at Sal. "Do you have anywhere to go?"

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"Certainly. Oswald took care of that. He's very resourceful."

"I got us lodgings in New York," Oswald said across the hold. "The Aamahh legation. They'll pay plenty for our linguistic knowledge, and tapestries, if they can get decent materials. They're suckers for cultural exchange."

"The Aamahh? I . . ."

"I would have called the Bern embassy, but I never did like Europe. Oh, and you can thank Almeyda for making the arrangements. Margaret wouldn't let me call myself."

"Is that so?" she said.

"Commercial regulations are explicit," said Margaret.

"And he didn't want me talking," Almeyda added.

"He did OK," Oswald said, shuffling toward Imsah. "You've had better at intermedia, but only once. *Ghanirr o, Imsah?*"

Imsah deferred him one moment. "Again, thank you," she whispered to Reyes. "For all the ways you have helped us." She brushed the back of her hand across Reyes's bare cheek. "Good-bye. *Oswald, o ghanirr.*"

Sal moved to Reyes's side as the two began walking away. "Did he just compliment me?"

"Yes, and lucky you had a witness. Nobody would believe you otherwise."

"Heh. Well, I'd better get going myself."

"You aren't going anywhere. We're expecting a delivery."

"Of what?"

"Food. A few days' worth, of better than mess hall quality." His confusion yielded, slowly. "We would be mobbed by newscasters in the city. This is a much better place to spend a quiet shore leave. Besides," she said with a gentle nudge at his ribs, "it's time you started appreciating some old-fashioned music."

"Oh. Well . . . I have to make some calls. Plans to cancel. Excuse me." He withdrew before bubbling over in her sight.

Reyes almost followed, before a voice carried to her. It was Oswald, singing to himself, and Imsah, in Italian. Reyes recognized it from *La Bohème*'s third act.

She listened to his fading voice, filling in the words in English.

"Solitude is like dying—
While in spring there's the sun for companionship."■

(EDITOR'S NOTE: Oswald Pitt's earlier encounter with Kuess and the Kihoa was described in "Finding a Voice," January 1999.)

The man who can make hard things easy is the educator.

—Ralph Waldo Emerson

What we want is to see the child in pursuit of knowledge, and not knowledge in pursuit of the child.

—George Bernard Shaw

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THE REFERENCE LIBRARY Tom Easton

Spinners, Anthony McCarten, Morrow, $24, 288 pp. (ISBN: 0-688-16303-3).

Flashforward, Robert J. Sawyer, TOR, $ 23.95, 320 pp. (ISBN: 0-312- 86712-3).

The Silicon Dagger, Jack Williamson, TOR, $23.95, 304 pp. (ISBN: 0-312-86540-6).

Parable of the Talents, Octavia E. Butler, Seven Stories Press, $24.95, 400 pp. (ISBN: 1-888363-81-9).

The Red Sky File, Denise Vitola, Ace, $5.99, 304 pp. (ISBN: 0-441-00601-9).

The Changeling War, Peter Garrison, Ace, $13, 352 pp. (ISBN: 0-441-00552-7).

Deep Time, Gregory Benford, Avon (Bard), $20, 225 pp. (ISBN: 0-380-97537-8).

After a while, those who read very much science fiction and fantasy are bound to mutter to themselves that though some is mediocre and some is excellent, there is a homogeneity that crosses all the lines of quality. Ho-hum. Same old same old. Much of a muchness.

You say, perhaps, that that is what "genre" means? To a large extent, you're right, of course. But every once in a while someone finds a way to expand the pattern to include something new. If we try to list those "someones," we wind up with a list of the greats of the field—Wells, Stapledon, Heinlein, Sturgeon, Tolkien, and . . .

Do you suspect that I'm leading up to another candidate for greatness? Well, no. What I have instead is something new, but in the kind of smaller, more ordinary way that keeps our hopes up between the greats. Anthony McCarten's **Spinners** is a fresh look at some old tropes. It's not a pattern-buster, but it's not the usual sort of SF. In fact, one could even argue over whether it's SF at all.

McCarten is a New Zealand playwright, well-known at home. Here he gives us a rural town whose chief industry is freezing cow parts. During the slaughter season, the assembly line gets very busy, but this is hardly enough to satisfy the town's youth, including Delia Chapman, who goes for a midnight walk and returns claiming to have seen a spaceship, to have been taken aboard, and to have been mated by aliens.

Or does she? The whole thing is just a bit too Yank for words, but the rural gossip mill, fed by speculation seized upon as fact, is a wonder to behold, and it is very easy for a young thing who craves to be the center of attention to agree that, yes, everyone says she said that so she must have. It soon emerges that she's pregnant, too. Two friends make similar claims. A squashed cow appears in a circle of flattened barley. A tabloid journalist shows up.

And so does a young man, nephew of the mayor, who is the new librarian, tracking down all the books that have been overdue for a decade, deciding that he likes Delia and is willing to be the Daddy if she will have him. Among the books, he reveals, are clues to the

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town's secrets—notes that reveal affairs, mingled pubic hairs, and more. Indeed, the key to events turns out to lie here, in the list of books once taken out by a certain disreputable character.

I'll say no more. McCarten is analyzing the basis of a popular delusion by turning considerable wit, polish, and charm upon a town populated by common, garden-variety fools, the sort that we are ourselves (at least at times). The result is comedy with a bite, and I commend it to your attention.

Robert J. Sawyer's twelfth novel, **Flashforward**, is as interesting as anything he's done lately. The premise is simple: Researchers at CERN's Large Hadron Collider, led by Lloyd Simcoe and Theo Procopides, are about to trigger a particle collision of record-setting energies, going for the long-sought Higgs boson and a pair of Nobels. Unfortunately, at the moment of the collision, everyone, all over the world, experiences two and a half minutes of what must be their future self, over two decades down the road. For some, that means a blackout—they're asleep in 2030, or they're dead. For the rest, it's a vision of their personal future. Lloyd sees himself in bed with a woman who is not his fiancé, Michiko, yet is clearly his wife.

Meanwhile, a vast number of airplanes, automobiles, and other devices on which human life depends have lost the attention of their human attendants. When consciousness returns to the present, the wreckage is piled high. Thousands have died, including the young daughter of Lloyd's fiancé.

The coincidence of timing is obvious enough for the CERN director to forbid any mention of the experiment. The word gets out soon enough, though, and perhaps strangely, the world is not in a blaming mood. Too many people were enchanted by their glimpses of the future. Many felt that they had been given a chance to set things right or avoid trouble; Theo, for instance, discovered he will be murdered shortly before the crucial moment; now he is obsessed with learning why and who and trying to figure out a way to forestall his death.

Lloyd has a different problem. He is engaged to a lovely woman. He loves her dearly. Yet his future features a different wife. Given that he is himself scarred by his parents' divorce, should he go ahead and marry Michiko? The marriage is clearly doomed, so why bother even if they do love each other now? Or is it doomed? Is the future fixed? If so, then is free will a mere illusion? Or should we go with the many-worlds interpretation of quantum mechanics? Minkowski? Or Wheeler?

There's enough angst there to drive a fellow nuts. Fortunately, a few people have decided they don't like the future they're headed toward; despite having been seen in other people's visions of the future, they have successfully committed suicide.

That settles some questions, at least well enough to be getting on. But it leaves plenty more, such as Theo's eventual murder, the mechanism of the Flashforward effect, the desirability of trying to repeat the experience, and more. The result is a novel full of very human pain and confusion on several levels, from the emotional ones of grief and love to the intellectual ones of theoretical physics and philosophy.

If you've enjoyed Sawyer's novels before, you'll have fun with this one.

Would you believe that Jack Williamson is the nearest thing science fiction has to a perpetual motion machine? He's ninety-one years old, and his first story appeared in 1928. In over seventy years of writing, he has created dozens of ideas and story types for others to imitate.

If his latest work doesn't seem likely to prove as seminal as *Darker than You Think*, *The Humanoids*, *The Legion of Space*, and so on, we shouldn't com-

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plain. He remains up to the standard of the market. And here's **The Silicon Dagger** to prove the point.

The theme is the barbarous, redneck, gun-ho America of Ruby Ridge and Waco. There is a conspiracy to strip god-fearing Americans of their god-given rights to private property and the fruits of their labors (they hate taxes and environmental regulations, among other things) and turn the U.S.A. over to an international cabal of U.N. tyrants. And it is time to Rise Up! Declare Our Independence! Rebel! Restore the One True America! And—whisper it, please, for it isn't obvious until late in the game—Put the Niggers in Their Place!

If my tone isn't clear, I think this is a very stupidly wrong-headed way to think. So does Williamson, who begins with the funeral of a writer, Alden Kirk, who was investigating the roots of terrorism in America and finding them in quiet country spots like Kentucky's McAdam County. Not long after his book came out, a letter bomb nailed him.

Half-brother Clay Barstow has been Alden's research assistant. Now the FBI tells him Alden was helping them out, and will he carry on? Go to McAdam County entirely unofficially. Make secret reports. Find Alden's killers.

How can he refuse? Off he goes, into a snakepit of a town ruled by the politics of kinship, graft, and conspiracy (the locals just see themselves writ larger and meaner when they look at Washington and the U.N.), possessed of its own little anti-gun control militia and a cult of anti-abortion fanatics. There are farmers pushed out of growing tobacco by anti-tobacco policies and kept out of equally lucrative dope-growing by other policies. There's even a research lab, run by the militia leader's genius brother, and it has come up with a "cryptophone" that allows communication the government can't eavesdrop on; the government is insisting on control of the device and trying to close down the business.

The locals, in other words, are righteously ticked off. A local intellectual blames it on the "silicon dagger" aimed at the heart of traditional values by the information revolution, but as Barstow meets an attractive college professor, a crusty newspaper editor, and others, it becomes clear that yahooism (egged on by social instabilities that long predate the transistor) is its own excuse. Given that, Williamson lets the situation he has set up go vigorously over the top until he has to wrap it up by forcing a chief villain to burst into a tearful *mea culpa*.

That's a weakness. My reaction was a heartfelt, "C'mon now!" But it did permit a relatively graceful exit and saved Clay from an ignominious end.

Octavia E. Butler is one of science fiction's premier talents. She is thoughtful, insightful, inventive, and superbly skilled at characterization. Many of her stories have important things to say about race and gender and the dynamics of civilized behavior. Her "Xenogenesis" series, for instance, will remain a benchmark in this vein for decades.

It is thus an occasion to break out the drums and pound on them gleefully when she puts new work before us, and here is **Parable of the Talents**. It's the sequel to *Parable of the Sower* (1994), whose chief character, Lauren Oya Olamina Bankole, founded Earthseed, a faith whose chief credos are that God is Change, which can be shaped and must be accomodated, and humanity's destiny is to go forth among the stars like dandelion fluff blown on the wind. *Talents* is told in the voice of Lauren's daughter Larkin.

America is a wreck. Government is powerless, children and adults are routinely enslaved, raped, and killed. Society has been taken over by its very worst elements, and now a form of the religious right as bad as, or worse, than Afghanistan's Taliban—a home-grown and empowered Koo-Koo Klan—has come to power.

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Earthseed has been planted in a tiny community, Acorn, but it is clearly heresy to the bigots. It is attacked and battered, but it endures, it survives. In the end, it wins out.

It is hard for a white man comfortable amid the snows of a Maine winter to believe in Butler's vision of how bad things might get. Yet I have also lived in Chicago. I know of the inner city, the projects, and the people of all races who are eager to exploit their fellows in the most degrading possible ways. I also know of the power of many inner city or project families (and rural ones, too, for that matter), headed by strong women, to inspire their children toward higher destiny, to aid their neighbors, to build community even when surrounded and threatened by social chaos. Butler seems to be building on this background, for Acorn is precisely the kind of community and Earthseed precisely the destiny these women build.

These then are the keynotes of *Talents*: family and characters, warmth and endurance, hope and determination. It's a worthy book, well up to Butler's standard for thoughtfulness and insight.

However, *Talents* does have features that did not much appeal to me. Its frequent use of Earthseed poetry struck me as pretentious. Its alternation of present events with excerpts from Mama Lauren's journals is more problematical, for it feels archly artificial (in the sense that one can see the artificer at work). Both of these comments, however, reflect my personal reaction; I expect the use of both poetry and journal entries will appeal much more to others.

I commend it to thee.

We see similar social degradation in our next title, Denise Vitola's **The Red Sky File**, which has one great strength in its sheer verve—the action never stops—but precious little else to recommend it. The economy of some unnamed country has gone to pot, and a dictatorial leader has rounded up assorted criminals—including mouthy college professors—and dumped them in a penal colony hundreds of miles square on the banks of the Black River (which Vitola once calls the Rio Grande). The setting is swamp and bayou and assorted industrial ruins walled in by fence and guards and patrolled by gunboats on the river. When a gruesome murder strikes one of those boats, the police show up in the person of Ty Merrick, lycanthrope, and her partner Larue and lover/physician/researcher Gibson.

So far, so good. We have what looks like a nice tale of the gritty, grotty underbelly of a future society that might once have been our own. The recipe must call for corrupt prison guards and a noble prisoner or two, and yes, they're there. But Vitola is a reckless writer. We can tolerate the jumble of souls, reincarnation, karma, and biochemistry in the name of bafflegab. Less forgivable is the way she free-associates, with her self-criticism locked totally out of the circuit. There is practically no thoughtfulness or insight to bind the whole together and thereby compensate for other deficits. The result is that "confab" becomes "conflab"; "polychlorinated biphenyls" (PCBs) becomes "polychlorinated bifemals"; mucus is equated with pus; and the murder weapon combines water, oxygen, and electricity into a deadly force, and it's the combination that kicks the user's shoulder, not the subsequent firing. Vitola apparently doesn't know that smallpox was declared extinct over twenty years ago and people are no longer vaccinated against it. She insists that intellectual dissidents and mass murderers are equally foul.

And she is guilty of lines such as, "'I love you,' he said softly. 'From the moment I laid eyes on your medical chart.' With that, he led me to the sick bay's anteroom, where we passionately expressed ourselves until it was time for my next blood test." This is the kind of writing that makes a reader laugh, but

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not in the right way. The target becomes the author, not the author's jokes.

To be honest, I must admit that I had an "uncorrected proof" to read. Some of the problems may be corrected by the time the book hits the stands. But I doubt that the most alarming ones will vanish. This one's flaws are too deeply embedded for editorial repair.

Peter Garrison's **The Changeling War** begins a new series that should prove interesting to fantasy readers. Our familiar Earth—one of three worlds linked in some magical way—is infested by Mr. Smith, a gray man who offers you Such a Deal! but for a price you never suspect until it is too late. For Eric Jacobsen, the price is that he must seek out young Karen Eggleston and shoot her. For the Petranovas, a small organized crime clan, it is to send out Joe Beast and Ernie P. to plug Karen's boyfriend Brian. Unfortunately—Mr. Smith has a nasty temper!—things go wrong. Joe and Ernie plug Brian's dad instead. Eric meets Karen's neighbor, Mrs. Mendeck, who opens up a hole in the floor and punts him off to the Castle.

That's the second of the three worlds (we don't see the third in this book). This one is infested with immortal Judges (wizards) and royal clans (named after colors) that have been warring with sword and spell for millennia. Beneath the green and pleasant surface lies a maze of tunnels built in ancient times. Some are home to the clans and Judges. Some are vacant, abandoned; some only seem so, for over the centuries many have fled the endless war, seeking refuge or a haven in which to work out their own schemes.

Eric lands in one of these tunnels. So does Aubric, a soldier of the Green who was resting with his companions when ambushers leapt out of the bushes. Only he had the seconds to get to his feet and run and run and run, until a hatchway opened and Summitch, an apparent gnarlyman, beckoned him below. Far too soon he is a prisoner of the evil princess Karmille (who dotes on pain), then on the run with the slave girl Runt, shepherded by a flock of flickering lights deep into the tunneled bowels of the Castle. Meanwhile, Eric has reached the enclave presided over by the metal man, Gontor, and they too are off into the depths. And so, of course, are Karmille and the Judge Sasseen, each intent on using the other for their own purposes.

Meanwhile, back on Earth, Karen and Brian are fleeing for their lives while Mr. Smith's minions pursue and Mr. Smith himself drops heavy hints about the significance of the title and the powers hidden within these two teens.

Garrison stops this first installment just before all the various paths through the book converge, presumably hoping that the reader will pant and slaver for Book Two in the series. I rather doubt that they will react quite that way, but this is good enough to ensure that Book Two will be received with pleasure. That should be enough.

Gregory Benford is not only a premier SF writer but also a physicist of some note. It is thus not terribly surprising that he should be interested in the distant future in more than one way. In his fiction, that way involves tales of eons-long conflicts between humans and machines (the "Galactic Center" series) and—in one famous case (*Timescape*)—of sending messages across time, from the future to now. In his physics, the problem seems simpler, sending messages from now to the future, but the simplicity is far more apparent than real, and that is the point of Benford's first nonfiction book, **Deep Time**.

He begins with the problem of marking the sites where we plan to store nuclear waste. Congress has mandated that the waste be isolated for ten millennia, until it is no longer a hazard to human health or the environment. This requires picking sites that are highly unlikely to

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be disrupted by earthquakes, volcanoes, or flood, where groundwater will not penetrate the repository and corrode the waste containers, where there are no ore bodies that will attract future miners. Yet it also requires sending a message into the "deep time" of distant millennia to tell whoever is then there to stay away from the sites.

Unfortunately, it is a safe bet that over ten millennia civilizations will fall and rise and fall again, languages will change beyond recognition, and monuments—even such massive structures as the pyramids, which are only five millennia old—will erode to nothingness. How can we send a message that will remain interpretable despite all such obstacles?

The problem is akin to that of sending messages attached to spacecraft such as the *Cassini/Huygens* mission destined for Saturn's moon, Titan. Here the weather is less a problem than sheer lack of common ground for communication—if ETs find the message, their minds may not work at all like ours, and they will certainly not share a language. Nor may whatever descendants of humans may be alive a million years from now.

Benford was involved in both these projects. Marking our waste sites remains an unfinished story. The *Cassini/Huygens* message died in an ego tempest and was replaced by a "Kilroy was here" list of 616,403 people who think they are important enough for their names to be preserved forever.

Benford was also involved in a proposal to freeze a random sample of the Earth's biota so that something will remain after the great die-off of species ecologists expect over the next few decades. Perhaps, he says, our wiser descendants will be able to use these icy remnants to resurrect the lost. Otherwise, the greatest message we leave to the future will be the scars—species lost, soil degraded, and climate warped—we laid across the world we inherited from our own forebears.

The "deep time" perspective is something that fails to impress most people. "The future" is at most a lifetime away; anything further off is irrelevant. But that, says Benford, is irresponsible error. The future is crucial to those who will live then, and we need to consider what we say to them, both deliberately and inadvertently.■

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BRASS TACKS

Dear Stan,

Congratulations and well done on your March 1999 editorial "Much Ado About Very Little."

It took a lot of courage to write that piece, and its timeliness was incredible, given that you are working with a six or seven month lead time.

I imagine you will lose a few subscribers over it, too. Well, *Analog* has never been intended for the brain dead. Keep up the good work. For my part, I am sending a copy to Henry Hyde.

TOM NAGEL

Dear Dr. Schmidt:

I was very disappointed by your editorial in the March 1999 issue of *Analog*. I had thought that at least *Analog* could stay out of the current political debate and maintain its focus on more important issues in the long term scheme of things. Not only was your piece inaccurate and biased, it was hardly germane to the issue at hand in your magazine: namely science fiction!

In the future please focus on your own area of expertise and stay out of politics. You grandly displayed that phenomenon of being very competent in one area and then assuming that your intellectual competence is transferable to other areas of knowledge.

Please let me enjoy your normally high quality periodical without having to wade through the political propaganda.

SINCERELY,
DAVID LESTER
P.O. BOX 8736
MISSOULA, MT 59807

Dear Dr. Schmidt:

I have three comments.

First, I thought the stories in the March issue were not up to your usual high standards, although the science fact stories were very interesting. I realize you are at the mercy of the writers and have to pick the best stories that are submitted, but this seems to have been a weak crop. Did you ever consider occasionally reprinting a story from the old days? I suspect many of your younger readers don't know about the writers of fifty years ago.

Secondly, your defense of Bill Clinton. I don't think it is the invasion of the morality police. I do believe there should be one set of rules for all and I don't believe the President should be held to a lower standard of conduct that you or me. If either of us did what he did with an intern young enough to be our daughter, we would be in the unemployment line the next day. Leaving that aside, I realize we aren't electing people based on sainthood. If we were, Jimmy Carter would be one of our greatest presidents instead of one of our worst. However, there is a real problem with having a man in office who has committed a felony. It is obvious Clinton committed perjury and most people would concede he probably obstructed justice as well. If nothing else, he has no credibility with anyone. We are fortunate that the problems Clinton has faced in office have been relatively minor as compared with those faced by his predecessors. Even so, when he wanted to drum up support last spring for an attack on Iraq he could not convince anyone. So he sent three cabinet officers to Ohio Sate. It looked like the sixties again, as a hostile crowd pointedly showed they didn't believe a word of what was being said. The Serbs don't believe him. Iraq doesn't either and is constantly testing us. At home, almost none of his programs even come close to being enacted. For a liber-

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tarian it is fine with me that he has been able to do almost zero in his time in office (which may help explain the strong economy), but it can be dangerous to have a leader who has no credibility.

Your comments about the Fermi Plague seem to have brought several readers into the mix. Dr. Jones seems to think we need to have a worldwide teaching course in the ethics of species survival. One might as well advocate perpetual motion. Obtaining such cooperation among countries, even if it is limited to NATO countries, for example, is impossible for the foreseeable future. There are those of us who are willing to run risks to the species for such things as liberty. Hence the MAD situation, which has successfully kept peace between NATO and the Warsaw Pact since 1945. I'm not happy about it, but it works and does not depend on a change in human nature, which seems very unlikely to ever happen.

Mr. Bellmore seems to believe that terrorism can be resolved by not offending the terrorists. This is simply nonsense. A simple reading of history, not to mention our current situation, demonstrates this position is without merit. There have always been terrorists. Some, such as anarchists and nihilists, are simply against any government. You satisfy them by eliminating all government, which is not something the vast majority of people agree with. Are we to abandon Israel to avoid Arab terrorism? If so, might we not suffer Jewish terrorism, as was practiced in Palestine prior to partition? Much of the terrorism of the last twenty years was sponsored by the former Soviet Union and its allies, especially Bulgaria. Should we have turned communist to stop annoying those people? In the thirties, fascist parties, especially the Nazis were all over Europe. Many countries did just as Mr. Bellmore advises and turned the government over to them to stop the terrorism. Even whole nations did the same, as at Munich. Did this stop the terror? Mr. Bellmore seems to think the sociopaths are in government. If so, they are there because we elected them. You can't please everyone. Some of those you displease will take to violence. An appeasement policy is not the answer. Capitalism and liberty are. While there are exceptions, few terrorists come from places where there is freedom and prosperity.

Which brings me to Dr. Sherbenou. I guess the ecologists' position that mankind is evil is alive and kicking. He criticizes mankind for greed, expansionist views, using underground water, mining soils, breeding, causing the extiction of various species, and pollution of air and water. Without doubt mankind does these things. Am I to assume Dr. Sherbenou is volunteering not to have been born? That he does not want to live a long life in circumstances that would be the envy of most previous generations? That he wishes his ancestors 100,000 years ago wouldn't have left Africa? That they would have stayed in the Old World? That he does not now want to explore space? Which things related to mining soil does he want to live without? His car? His house? The highways? Trains, airplanes, ships? Mankind has always altered things. When he planted the first crops about 15,000 years ago I'm sure there was something effected. I don't advocate extinction of any species (well, maybe some such as smallpox, polio, etc.), but such things do happen even without the intervention of mankind. There is considerable evidence that pollution, at least in the developed countries, is getting better, not worse. Underground water does not have any use for any life as long as it is underground. Assuming the water is eventually used up, so what? Are we worse off than if we never used it? Who should starve so that the water stays in an aquifer? Can we do better? Sure. We should try. However, the thing to remember is that greed is the engine that drives it all. Only those people who are prosperous can afford to limit their birth

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rate, pay extra for pollution control measures, set aside wilderness areas, etc.

What we need to do is to encourage liberty and capitalism world wide. I believe it would resolve all of the problems we will have for the foreseeable future.

PHIL TRICE

You're quite right that many younger readers have missed a lot of older writers, but with very rare exceptions I don't think the magazine is the best place to reprint them; there are too few outlets for new stories, and I (and apparently most of our readers) don't want to further reduce the space available to them. We do, however, sometimes reprint stories in anthologies. (See, for example, Roads Not Taken, *Del Rey, 1998).*

I did not intend anything I wrote as a "defense of Bill Clinton." Please see more on this later in this column. . . .

Finally, while you've raised some good new points in the "Fermi Plague" discussion, beware of oversimplifying your opponent's viewpoint! (In this connection, I humbly suggest that you might reconsider my editorial Tilting with Straw Men" [July 1992].)

Dear Mr. Schmidt,

Your editorial in the March 1999 issue of *Analog* succeeded in bringing to light an important deficiency in the character of the culture of the United States: an overly Puritanical bent. I agree wholeheartedly that too much time is spent investigating inappropriate but legal actions. The prevalence of daytime kiss-and-tell and prime time news like "real" reporting indicates a significant misappropriation of resources.

However, you used the latest scandal (in a sadly long series) of the Clinton administration. The sordid details of a president's life are not of national importance, but they may be germane to a legal proceeding on a civil offense, to wit a sexual harassment case. Not being a lawyer, I am not in a position to judge the relevance of the line of questioning involving Monica. However, as a citizen, I believe the ability of a public servant to give a straight answer when being questioned in front of a grand jury is an critical aspect of their job requirements.

While it has become cliché that a politician's promise isn't worth the paper it's written on (how did we let this become a cliché?), if an individual can *never* be trusted under *any* circumstance (such as, when sworn to tell the truth in front of a grand jury), then the individual can not be trusted with a public office.

JAMES DAMOUR
damour@capital.net

The March editorial drew a lot of letters, quite a few of which missed some important points about it. First, it was not *"about Bill and Monica," and most definitely not "a defense of Bill Clinton." It* was *about a cultural tendency, exacerbated by technological developments (which is* precisely *the sort of thing science fiction is about!), to apportion time, interest, and money to issues in ways that have little or no correlation with their real importance. I did not condone the president's actions or suggest that he should get away with them, but merely said that they should be treated as a separate issue from his job performance—and I said* nothing *about that. Please note also that, because of the several-month lead time mentioned by Mr. Nagel, the editorial was written well before impeachment. By that time there were, of course, more things to consider than the original rather trivial offenses (on which the best comment I heard was "This is grounds for divorce, not impeachment"), but I still question whether the original matter should have been allowed to snowball into one of the most grotesque chapters in American history. When I wrote the editorial, I was merely concerned that this business was consuming too much attention from people who evidently lacked enough of real interest in their own*

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lives, and that even the government seemed to be devoting too much of its attention to it. Had I written it after the impeachment move really got rolling, I probably would have been even more emphatic on that point—because by then, the highest branches of government were most definitely giving it practically all *their attention, while matters of far more national concern were being ignored. There* must *have been a better way to handle it! It may well be that people in many other jobs would lose their jobs for similar offenses, but they would* not *tie up the highest levels of government for months doing it.* That, *not what happened to the current holder of any particular job, was my concern.*

Dear Dr. Schmidt:

Dr. Hugh Jones responded to your editorial "The Fermi Plague" by suggesting ". . . a universal educational system that teaches the ethic . . . of species survival. And to ensure that this education is effective, there must be a really stringent, and automatic, final examination: you either pass it or you die!"

Such a system is in fact in place. Further, the exam is in progress. What Dr. Jones may not have considered is that the pass/fail grade is given, not to individuals, but to the graduating class as a whole.

Fortunately, it's an open-book test. Thanks to *Analog* for being one of the better textbooks.

DAVIDSON CORRY
1404 SW 126TH ST.
SEATTLE WA 98146

Dear Dr. Gillett,

"Trendy?" *Moi?* No. Your confusion results from a poor reading of what I actually wrote in the October column. Your inattention to both nuance and context perhaps led you to think I'm some kind of advocate for Deconstructionism, which is trendy and usually silly. Your own capsule description of science is quaint and more than a little naive—in other words, both typical and part of the problem. The US just had an impeachment episode—that people believe what they want to believe was much in evidence. My view can be summarized as follows: "Scientists are human."

You say: "(M)ost scientists get very impatient with the metaphysical discussions of Truth—a fact that surprises many laypeople." It surprises many laypeople because regardless of whatever ideal scientists pay lip service to, many act as if they're in search of the Truth or are the sole possessors thereof (This is why the dissidents whisper to each other with their office doors closed lest the paradigm police deny them tenure).

We agree that textbooks "present the consensus," then you add: "But the reason it's a consensus is because it accounts for lots and lots and lots of observations." Yes, and it accounts for those observations all the better by ignoring the pieces that don't fit. You can have a theory that will account for everything in the Universe if you ignore all those things in the Universe for which the theory gives no account.

You say: ". . . to evaluate those anomalies, you also need to be thoroughly familiar with the observations that make the mainstream view mainstream." I agree. Observations like: 1) "Most scientists don't like anomalies, so they don't look at them and hope they'll go away." Or better: 2) "Graduate students who pursue studies of anomalies don't get their doctorates." Granted, all anomalies are not created equal—so why are they routinely *treated* that way? Note observations 1 and 2 above.

You say: "Not all anomalies are to be taken seriously . . . they must be weighed in the context of the vast number of 'non-anomalous' observations. . ." By what vast voodoo does one accomplish this, when the typical scientist is unaware of all the other anomalous bits and pieces (no doubt equally weighed in context and not taken seriously) swept under the rug by the know-it-alls who came before? It is impossible to find pat-

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terns amongst the anomalies when you are unaware of the anomalies.

If anomalies were simply set aside, classified as such, and kept in mind as issues to be cleared up later, I'd have no complaint. Instead, they are largely discarded and forgotten by the vast bulk of the scientific community. As if this were not enough to make honest men cringe, scientists who take anomalies seriously are often denigrated (i.e. accused of being "trendy," or of not understanding science). I take anomalies seriously because science progresses in her greatest leaps when it is noticed that ye olde "anomalous observation" was in fact the tip of an iceberg and not just some jetsam in the sea of knowledge.

You say: ". . . there's a host of geochemical, mineralogical, and isotopic data, derived from meteorites and interplanetary dust particles, that strongly suggests the asteroids were never a single body." You are referring to Tom Van Flandern's "exploded planet hypothesis." Since I have yet to write an article on this, it is both rude and unfair to the readers and to me to preemptively attack an idea about which they are largely unaware. (What were you thinking?) For that matter, Van Flandern's model has never asserted that the asteroids were part of a *single* body, which makes your comment extremely misleading with respect to Van Flandern's ideas.

Be that as it may, your assertion that there is a *host* of data is telling and exposes the fuzzy scientific thinking typical in these matters quite well.

Unless you and your buddies have been the beneficiaries of sample return missions from, say, the core of Neptune, and other relevant sections of the Solar System, you don't have more than a thimbleful of data. You've got scrapings from the surface of this planet, nothing from the really deep interior, and all of the examined extraterrestrial material wouldn't fill a duck pond. From this *paucity* of data you draw inferences, and your data is organized via a model which doesn't include exploding planets as a possible dispersion mechanism. Yes, I'm sure you don't *need* an exploding planet to account for your data. Paleontologists didn't need an asteroid impact to kill off the dinosaurs either. I'll save the rest of my discussion of the exploding planet hypothesis for when I actually write those columns, except I should point out that nothing in your own models accounts for the large number of anomalous observations—Solar System-wide—that can be deduced *a priori* via the exploding planet hypothesis.

But let's look at that isotopic data. Have you, or has anyone else in your profession, yet bothered to consider just how the fact that low-temperature nuclear transmutations can occur might impact your understanding of what your isotopic data *means?* I would guess not. No doubt you're all waiting for someone you have *faith* in, like the fusion physicists, to put their stamp of approval on the experimental results (results which they to date have "weighed in context and not taken seriously" via the scientific approach of name-calling and data-ignoring). What this means is that your discipline is a decade behind where it could be. I don't know about you, but I'm too Type-A to wait for everyone else to catch up.

Finally, you say: "To be truly 'paradigm shifty,' new ideas must incorporate all observations, not just anomalous (and glamorous) ones." By that standard, we would never have gotten to heliocentrism, nor to relativity, either special or general, nor to quantum mechanics. We wouldn't have classical electromagnetism (which isn't even self-consistent, let alone able to account for all the observations, starting with Faraday's work), nor continental drift, nor evolution. It is never the case that paradigm shifty ideas account for all observations, just as it is never the case that the consensus model accounts for all observations.

JEFFERY D. KOOISTRA

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UPCOMING EVENTS Anthony Lewis

20–22 August 1999
NECRONOMICON 4 (Horror-oriented conference) at Marriott Hotel, Providence RI. Guest of Honor—Fred Chappell; Special Guest—T.E.D. Klein. Info—NecronomiCon, Box 1320, Back Bay Annex, Boston MA 02117. Email—necronomicon@necropress.com; URL—www.necropress.com/necronomicon/main.shtml

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26–29 August 1999
CONUCOPIA/NASFiC '99 (North American SF Conference) at Anaheim Marriott, Anaheim CA. Guest of Honor—Jerry Pournelle; Editor Guest of Honor—Ellen Datlow; Fan Guests of Honor—Dick & Nicki Lynch; Registration—$100; $20 supporting. Info—Conucopia/NASFiC '99, c/o S.C.I.F.I. Inc., Box 8442, Van Nuys CA 91409. Email—info@99.nasfic.org; URL—www.99.nasfic.org

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2–6 September 1999
AUSSIECON THREE (57th World Science Fiction Convention) at World Congress Centre, Melbourne, Australia. Guests of Honour—George Turner (in memoriam), Gregory Benford, Bruce Gillespie. Registration—$170 (A$250) until 31 July 1999; supporting $35 (A$45). This is the SF universe's annual get-together. Professionals and readers from all over the world will be in attendance. Talks, panels, films, fancy dress competition—the works. Info—Aussiecon Three, GPO Box 1212K, Melbourne VIC 3001, Australia. US Agent—PO Box 266, Prospect Heights, IL 60070-0266. URL—www.aussiecon3.worldcon.org

10–12 September 1999
ARMADILLOCON 21 (Austin-area SF conference) at Omni Southpark, Austin, TX. Guest of Honor—Sean Stewart, TM—William Browning Spencer. Registration—tba. Info—ArmadilloCon 21, PO Box 27277, Austin, TX 78755. (512) 868-0036. Email—mona@io.com

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1–3 October 1999
VIABLE PARADISE III (Cape and Islands area SF conference) at Island Inn, Oak Bluffs, MA. Guest of Honor—Joe Haldeman, Artist Guest of Honor—Rick Berry, Fan Guests of Honor—Ted and Bonnie Atwood, Net Guests of Honor—James D. Macdonald and Debra Doyle. Registration—$40. Info—Martha's Vineyard SF Association, PO Box 3404, Oak Bluffs, MA 02557. Email—paradise@rmontor.tiac.net; URL—www.sff.net/paradise OR www.tiac.net/users/rmontor/paradise

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4–7 November 1999
WORLD FANTASY CONVENTION/VOYAGES at Rhode Island Convention Center, Westin Hotel, Biltmore Hotel, Providence, RI. Guests of Honor—Patricia A. McKillip, Charles de Lint, Robert Silverberg, Leo & Diane Dillon; Special Guest—Samuel R. Delany; TM—John M. Ford. Registration—$125 (limited to 850); $35 supporting (payable to MCFI). Info—World Fantasy Convention, c/o MCFI, Box 1010, Framingham, MA 01701—1010. Fax—617.776.3243. Email—wfc@mcfi.org URL—http://www.mcfi.org/wfc

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TECHNOLOGY UPDATE

Stealth antenna hides under gutters but performs like big ugly antennas

The new Max Antenna by GE is the low-profile, high-gain way to get flawless reception of broadcast signals without expensive installation.

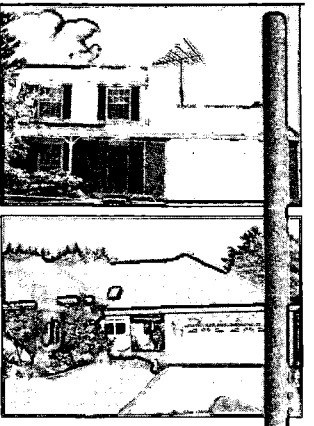
by Hope Chapman

The Max Antenna by GE is the ultimate TV antenna system.

Electronic engineers agree—your television is only as good as the signal it receives. Unfortunately, antenna design has not kept pace with improvements in television quality and the features available. Both cable and satellite television systems have spent a great deal to improve the quality of their transmission, but they can be extremely expensive, they aren't available in all areas and may not provide access to local TV stations. Luckily, there is a new antenna from GE that will provide breakthrough performance without making your family room look like something out of the fifties.

Clear alternative. The Max Antenna series from GE uses a revolutionary electromagnetic design to maximize installation flexibility and yield longer range reception of off-air VHF and UHF signals. Unlike a conventional dipole antenna, the Max Antenna can receive signals in both vertical and horizontal planes with minimum cross-polarization loss. This design allows for the first low-profile antenna solution that provides numerous installation options.

Superior components. The key to the superiority of this antenna is its ingenious use of the latest electromagnetic technology—providing high gain and full channel coverage as well as the greatest amount of mounting flexibility. First, the antennas were designed around a wide band element to achieve the greatest amount of gain in a relatively small space. Next, an amplifier and matching network was designed to enhance the reception of weak signals. This amplifier also adds very little distortion to the strong signals, giving it a balanced amount of gain. A filter on the amplifier board will allow for good matching between the antenna and amplifier. Special attention was paid to design an antenna-amplifier combination that would be completely compatible with the new digital transmission format. It has been designed for strong signal distortion rejection and a low amount of noise. It is omnidirectional and requires no adjustments, orienting or fine tuning during use. You simply install it, set it and forget it.



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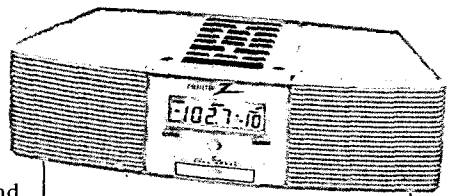
TECHNOLOGY UPDATE

Big sound from a stereo radio—without the big price!

Zenith Audio, a leading electronics manufacturer designs a "Small Footprint," "Big Sound" stereo system and drives the price below $100.



Micro-Electronic Sound Breakthrough

State of the art stereo sound quality in a stylish cabinet

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- Digital Weather Band
- 37 Preset Station Memories
- Ascending Tone Alarm
- Wake/Sleep to Radio, Weather or TV Band
- "Fail-safe" Alarm System

Zenith Audio has developed a Digital Stereo Clock Radio that boasts the acoustic quality and practical features of stereo radios four times as expensive. You'll be amazed at the sound quality and powerful bass you get from a radio this small and this affordable. This stereo radio features an 11-key hand-held remote control and an input jack for CD players or other audio sources.

Loaded with features. The AM/FM radio features digital tuning for pinpoint reception and crystal-clear sound. The STEREO indicator allows you to tune in to the stereo signal. It also picks up TV and WEATHER signals with 13 TV channels and 7 Weather channels, so your Zenith Audio Clock Radio is a great source of news, entertainment and information. You can program the unit's memory for 37 preset stations, and the tuning buttons can operate either manually or in a automatic search mode.

Practical functions. The backlit clock has several alarm functions, so you can wake to either radio, TV, weather or a buzzer. The sleep timer allows you to fall asleep to up to 90 minutes of music, TV or weather and then shuts off automatically. In the morning, if you need a few extra minutes of sleep, press the SNOOZE bar on the control panel or on the remote. The radio or alarm tone stops for 10 minutes and then sounds again. The unit's battery backup system will maintain the time, alarm and preset station memories in the event of a temporary power interruption.

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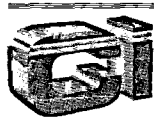

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